# EFFECT OF PURSLANE SEEDS (*PORTULACA OLERACEAE*) ON GROWTH PERFORMANCE, FEED UTILIZATION AND BODY COMPOSITION OF NILE-TILAPIA (*OREOCHROMIS NILOTICUS*)

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***Abstract***

This study was performed to investigate the effect of dietary supplementation with Purslane seeds (*Portulaca oleraceae*) on growth performance, feed utilization and body composition of Nile-tilapia (*Oreochromis niloticus*) fingerlings with an average 5 ± 0.21g. A 12-week feeding trial was conducted in 12 aquariums (75 – 60 – 45cm in diameters).with three replications per treatment. Four experimental diets were formulated to containing 0% (control), 1, 2 and 3% Purslane seeds. All experimental feeds contained isonitrogenous (30% crude protein) and isocaloric (458 Kcal gross energy/100g). The results revealed that Purslane seeds supplementation significantly enhanced the fish growth over the control group. Also, condition factor and survival rate were significantly increased with increasing Purslane seeds percentage in the diets. While, feed conversion ratio gradually significantly improved with increasing Purslane seeds percentage in the diets 2% inclusion level after that, without significantly increased. Body protein content was significantly increased with increasing Purslane seeds percentage in the diets. While moisture and fat content were significantly decreased with increasing Purslane seeds percentage in the diets. On other hand ash content was not significant difference by diet.

It could be concluded that the dietary addition of 2-3% powder of Purslane seeds enhanced the growth performance, feed utilization and body composition of *O. niloticus* fish.

## INTRODUCTION

Several feed supplements have been used to improve growth performance and health status in various fish. Recently, research has increased on the supplementation of medicinal plants in trial to produce organic fishes. Purslane is native to Indian sub-continent and now widely distributed across the continents actually as a wild weed. It is actually hard herb plant requiring comparatively less water and soil nutrients and grows well in sunny conditions. Purslane seeds, appear like black tea powder, are often used to make some herbal drinks. Although purslane is considered as a weed in Egypt and in the United States because of its growth patterns, it can be eaten as a leaf vegetable, with a slightly sour and salty taste in Europe, Asia and Mexico (Taha *et al*., 2012).

Purslane *(Portulaca oleracea*) has been reported to produce various beneficial effects, including growth promotion, immunostimulation and antimicrobial effects in fish**.** It is rich in vitamins A, C, and E, as well as the minerals calcium and magnesium. Purslane has been recently identified as an excellent source of alpha-linolenic acid. Alpha-linolenic is an omega-3 fatty acid, also known as fish oil Moreover, purslane extract shows an antioxidant activity based on phenolic compounds (Simopoulos, 2004; Lim and Quah, 2007, Lu *et al.*, 2009 and Xiaojuan *et al.*, 2011). The seeds of purslane are more effective than the herb and are of good use (Culpeper, 1995). In addition, seeds contain a fixed oil of about 17.4% concentration and containing beta-sitosterol (Burkill, 1997). The seeds are taken as a sedative, demulcent, slightly astringent, diuretic, to quench the thirst, and to provoke menses (Vakili and Zarei, 2013). The polysaccharide from P. oleracea L. (POP) is used in treatment of type 2 diabetic mice resulting in a significant decrease in the concentration of fasting blood glucose (FBG), total cholesterol (TC) and triglyceride (TGs) in diabetic mice (Nadkarni and Nadkarni, 1999) A number of studies have investigated the effects of *Portulaca oleracea* on mice (Ali *et al.*, 2014), Moghani

Lamb (Golshan-Zoroofi *et al*., 2013) and broiler Chicks (Vakili and Zarei, 2013), but no previous research has been conducted in aquaculture. Research in medicinal plants for aquaculture is at an early stage of development and much work is still needed.

The aim of the present investigation was to provide information on the influence of dietary administration of Purslane seeds on growth performance, feed utilization and body composition of Nile-tilapia (*O. niloticus*).

## MATERIALS AND METHODS

### Fish experimental.

Nile tilapia, *Oreochromis niloticus* with an average 5 ± 0.21g was obtained from the fish hatchery, Central Laboratory for Aquaculture Research, Abbassa. They kept for 2 weeks in indoor tank as an acclimation period to the laboratory conditions. Fish fed on a prepared diet containing 30% crude protein.

### Feed preparation.

Four experimental diets were prepared in the laboratory. A control diet consisted from standard prepared diet without any treatment. The second, third and fourth diets containing *Portulaca oleracea* seeds obtained from local market at a concentration of 1, 2 and 3% 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, 1993). 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** | 9.2 | 9.13 | 9.07 | 9.05 |
| **Soya meal** | 52.5 | 52.33 | 52.12 | 51.84 |
| **Yellow corn** | 19.5 | 19.45 | 19.40 | 19.35 |
| **Starch** | 8.0 | 7.29 | 6.61 | 5.96 |
| **Corn oil** | 1.8 | 1.8 | 1.8 | 1.8 |
| **Fish oil** | 2.0 | 2.0 | 2.0 | 2.0 |
| **[*]Vit. & Min. mex** | 3.5 | 3.5 | 3.5 | 3.5 |
| **Cellulose** | 3.5 | 3.5 | 3.5 | 3.5 |
| ***Portulaca oleracea* seeds** | 0 | 1 | 2 | 3 |

[*] Each 100 gram of vitamin and mineral contained**:**
**Mineral**s: 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 *P. Oleracea* seeds.

| Items | Diet 1 | Diet 2 | Diet 3 | Diet 4 |
|---|---|---|---|---|
| **Dry Matter** | 91.30 | 92.51 | 92.11 | 92.04 |
| **Crude Protein** | 29.84 | 30.02 | 30.11 | 29.98 |
| **Crude Fat** | 9.76 | 9.67 | 9.78 | 9.82 |
| **Ash** | 7.24 | 6.85 | 7.40 | 6.91 |
| **Fiber** | 5.11 | 5. 18 | 4.98 | 5.53 |
| **[1]NFE** | 48.05 | 48.28 | 47.73 | 47.76 |
| **[2]G.E.(Kcal/100g)** | 457.92 | 459.03 | 458.31 | 458.08 |
| **[3]P/E ratio** | 65.11 | 65.40 | 65.64 | 65.39 |

[1]NFE (nitrogen free extract) = 100 – (protein % + lipid % + ash % + fiber %).
[2]GE (gross energy) was calculated after NRC (1993) as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.
*[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 15 fish/aquarium (75 – 60 – 45cm in diameters). Each aquarium was filled with dechlorinated 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 5% 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 powder of *P. oleracea* seeds).
Group tow (G2): Diet with 1% of powder *P. oleracea* seeds.
Group three (G3): Diet with 2% of powder *P. oleracea* seeds.
Group four (G4): Diet with 3% of powder *P. oleracea* seeds.

At the end of the experimental period (3 months), 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, 1990 and NRC, 1993).

**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).

**Condition factor (K).**

$K = \text{weight} / \text{length}^3 \times 100$

**Statistical analysis**.

Statistical analysis was performed using the Analysis of variance (ANOVA) tow way classification and Duncan's multiple Range Test, (Dunkan, 1955) 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, 2000).

## RESULTS AND DISCUSSION

*P. oleracea* is listed in the World Health Organization as one of the most used medicinal plants and it has been given the term "Global Panacea" (Lim and Quah, 2007).

**Chemical analysis of seeds.**

The chemical analysis of seeds was illustrated in (Fig, 1). In this connection Obied *et al.* (2003) found that proximate analysis of *P. oleracea* indicated high crude protein (17.9%), crude fiber (20.3%), fat (5.6%), Mg (3.5%) and Ca (1.8%) contents. Also Xin *et al*. (2008, reported that the ash and crude lipids contents for dried purslane were 20.6% and 2.3%, respectively, while the crude protein and fiber contents were 15.0% and 5.8%, respectively.

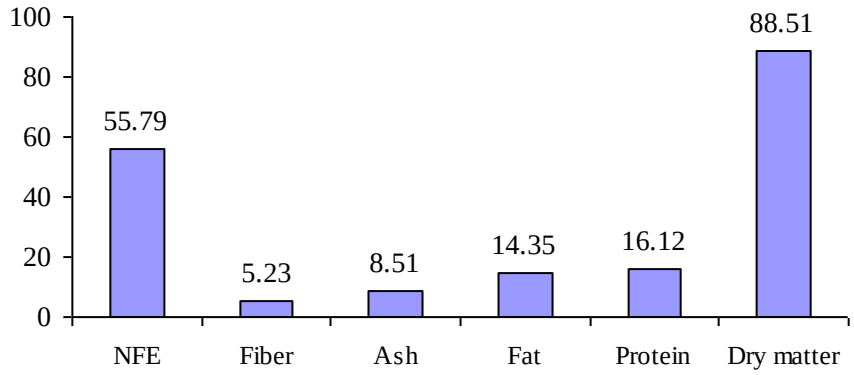


**Fig. 1.** Chemical composition of powder *P. Oleracea* seeds.

**Growth performance.**

The growth performance and survival rates of the fish are presented in Table (3). At the end of feeding trial, body weight gain was significantly high in all fish groups than in the control group. The body gain, condition factor and specific growth rate showed significant increase in the fed supplemented diets groups compared with control group. Fish survival in all fed supplemented diets groups was significantly high and ranged from 90 to 100% compared with control (80%). The positive growth promoting effects of purslane may be due to their chemical and physical properties. Recent research demonstrated that purslane is a good source of compounds with a positive impact in human health. Those compounds include omega-3 fatty acids and β-carotene, vitamins and essential amino acids, α-tocopherols, ascorbic acid, and glutathione, as well as phenolics, and coumarins. Organic acids are also presentand alkaloids have been reported to be important chemical constituents of this species (Simopoulos, 2004). These results are in agreement with Golshan-Zoroofi *et al*. (2013) they reported that adding Purslane to diet up to 15 % as substituted amounts with alfalfa did not showed any significant difference on growth performance by Moghani Lamb. Medicinal plants used as natural growth

promoters have significant improvements on body weight, weight gain, and survival rate in fish (Ahmad *et al.,* 2009 and Abbass *et al.,* 2010). Also Zaki *et al*. (2012) studied the effects of diets supplemented with six different medical plants for Nile tilapia fry they found that supplementation level of 1 % revealed significantly ($P \leq 0.05$) the highest growth performance parameters. El-Marakby *et al*. (2014) showed that Nile tilapia fed on diet containing 1% dried rocket leaves showed the highest final weight, weight gain, and SGR in comparison to control diet. On other hand Abdelhamid and Soliman (2012) stated that no significant differences in final fish weights, weight gain. Specific growth rate and survival rate of Nile tilapia fry (0.28 g) due to the dietary inclusion of fenugreek. But the dietary inclusion of Cresson (particularly at 1 % level) improved each of final weight and weight gain, but not significantly increased specific growth rate and survival rate comparing with the control (free of Cresson).

**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** | $5.17\pm0.12^{a}$ | $5\pm0.55^{a}$ | $5.39\pm0.32^{a}$ | $5.12\pm0.51^{a}$ |
| **Final Weight** | $18.15\pm1.12^{c}$ | $22.71\pm1.85^{b}$ | $26.72\pm1.23^{a}$ | $27.37\pm0.95^{a}$ |
| **Weight gain** | $12.98\pm0.91^{c}$ | $17.71\pm0.25^{b}$ | $21.33\pm0.53^{a}$ | $22.25\pm0.72^{a}$ |
| **SGR** | $1.4\pm0.12^{c}$ | $1.68\pm0.21^{b}$ | $1.78\pm0.11^{ab}$ | $1.86\pm0.51^{a}$ |
| **Condition Factor** | $1.22\pm0.01^{c}$ | $1.51\pm0.04^{b}$ | $1.59\pm0.01^{a}$ | $1.57\pm0.15^{ab}$ |
| **Survival Rate** | $80^{c}$ | $90^{b}$ | $100^{a}$ | $100^{a}$ |

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

## Feed utilization.

Feed intake (FI) increased significantly, ($P<0.05$), while FCR improved significantly in diets supplemented with different levels of *P. oleracea* seeds meal (Table 4). *P. oleracea* has recently been identified as

the richest vegetable source of α -linolenic acid (ALA), an essential omega-3 fatty acids (Simopoulos and Salem, 1986). Similar results were recorded by Ahmad *et al.* (2009) and Abbass *et al.* (2010) they found that feed consumption was higher in the medicinal plants-fed Nile tilapia throughout the experimental period and the control group exhibited the lowest feed intake. In this experimental fish fed 2 and 3% *P. oleracea* gave significant increased in protein intake and PER than control diet. Similar results were obtained by Golshan-Zoroofi *et al*. (2013) who reported that adding Purslane to diet up to 15 % as substituted amounts with alfalfa considering high nutritive value of Purslane in compared to alfalfa for Moghani Lamb. Tonsy *et al*. (2011) indicated that supplementation level of 1 % medicinal plant revealed significantly the best feed and nutrient utilization parameters but feed intake was not significantly difference by all medicinal plant levels for mono sex Nile tilapia. More nearly results were obtained by Antache *et al*. (2013) who found that the best FCR and higher values PER were found in thyme (Thymus vulgaris), followed by fenugreek (Trigonela foenum graecum), neem (Azadirachta indica) and control diet at *Oreochromis niloticus*, with an average initial weight of 125.41±34.33g/fish. Abdelhamid and Soliman (2012) confirmed that Fenugreek Seeds had significantly (and proportional to the increase in its addition level) improved the feed utilization in form of protein productive value and energy retention. The same authors added that, Cresson Seeds revealed improving effect of this feed additive (particularly at 1 %) on feed utilization (feed protein intake, protein efficiency ratio and energy retention) for Nile tilapia fish.

**Table 4.** Feed utilization, Feed Conversion Ratio (FCR), Protein intake and Protein Efficiency Ratio (PER) by Nile tilapia fed on ration containing different levels of *P. oleracea* seeds.

| Item | Control | 1% | 2% | 3% |
|---|---|---|---|---|
| **Feed Intake** | $32.12\pm0.21^{d}$ | $35.18\pm0.81^{c}$ | $37.49\pm1.21^{b}$ | $38.15\pm1.38^{a}$ |
| **FCR** | $2.47\pm0.25^{a}$ | $1.99\pm0.21^{b}$ | $1.76\pm0.08^{c}$ | $1.71\pm0.18^{c}$ |
| **Protein Intake** | $9.58\pm0.11^{c}$ | $10.56\pm0.23^{b}$ | $11.29\pm0.51^{ab}$ | $11.44\pm0.81^{a}$ |
| **PER** | $1.35\pm0.05^{c}$ | $1.68\pm0.18^{b}$ | $1.89\pm0.11^{a}$ | $1.94\pm0.23^{a}$ |

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

**Body composition.**

Table 5 shows the whole-body composition of Nile tilapia at the end of the experiment. No significant difference was observed in moisture contents for Nile tilapia fed diets contains different levels of *P. oleracea* seeds. A significant increased in crude protein was noticed in the groups fed supplemented diets with *P. oleracea* compared with the control one. A significant reduction in body fat contents was recorded in the fed supplemented diets groups compared with the control group. On the other hand, ash content was not significantly differences between all diets groups or control diet. Similar results were finding by Golshan-Zoroofi *et al*. (2013) who reported that adding Purslane to diet up to 15 % as substituted amounts with alfalfa did not showed any significant difference on Moghani Lamb performance and cold carcass. Also El-Marakby *et al*. (2014) demonstrated that protein content in fish body was higher, while lipids were lower in fish fed dried rocket leaves supplemented diets than that fed the control diet. Zaki *et al*. (2012) indicated that supplementation level of 1% different six medical plants for mono six Nile tilapia revealed significantly the highest CP %, EE % and energy content (Kcal /100g). On the other side, who added that the analysis of variance for all medicinal plant levels was not significantly differed in DM %. Abdelhamid and Soliman (2012) confirmed that

fenugreek Seeds (at 2% addition level) had significantly increased fish carcass protein percent, while Cresson seeds additive (particularly at 1 %) increased fish carcass ether extract and energy content.

Pharmacological (medical) studies show that it exhibits a wide range of biological effects, including skeletal muscle relaxant effect, analgesic, anti-inflammatory, antifungal, antidiabetic, antiulcerogenic, lowers acute exercise induced oxidative stress, anti-hypoxic, and antifertility effects (Li *et al.*, 2009 and Xiaojuan *et al.*, 2011).

**Table 5.** Proximate chemical composition (% on dry matter basis) of experimental fish fed diets containing different levels of *P. Oleracea* seeds meal at the end of the experiment**.**

| Item | G1 | G2 | G3 | G4 |
|---|---|---|---|---|
| **Moisture** | 77.12±0.05[a] | 76.88±0.07[a] | 75.15±0.11[b] | 75.54±0.10[b] |
| **Crude Protein** | 59.65±1.02[c] | 63.29±1.01[b] | 65.76±1.12[a] | 63.53±1.05[b] |
| **Ether Extract** | 26.17±1.51[a] | 22.39±1.05[b] | 20.57±1.04[c] | 22.45±0.09[b] |
| **Ash** | 13.77±0.18[a] | 14.0±0.14[a] | 13.43±0.32[a] | 13.66±0.52[a] |

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

It could be concluded that, the use of *P. oleracea* seeds in aquaculture can promote growth, feed utilization and body composition of fish. These benefits are important in aquaculture because it favor environmentally friendly organic production.

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# تأثير بذور الرجلة على أداء النمو والاستفادة من الغذاء وتركيب الجسم فى أسماك البلطى النيلى

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*المعمل المركزى لبحوث الثروة السمكية ، مركز البحوث الزراعية ، وزارة الزراعة ، مصر.*

## الملخص العربى

قد أجريت هذه الدراسة لمعرفة مدى تأثير المكملات الغذائية من بذور الرجلة على النمو والاستفادة من الغذاء وتركيب الجسم فى أسماك البلطي النيلي بمتوسط (٥جم ±٠.٢١). تم اجراء التجربة لمدة ١٢ اسبوع واستخدم ١٢ حوض زجاجى (ابعاد كل حوض ٧٥× ٦٠ × ٤٥ سم). تم تكوين أربعة علائق تجريبية تحتوي على ٠٪ (كونترول)، ١، ٢ ، ٣٪ من بذور الرجلة. جميع العلائق تحتوى على ٣٠% بروتين خام ، ٤٥٨ كيلو كالورى الطاقة كلية لكل ١٠٠ جم ونسبة طاقة الى البروتين ٦٥ مج بروتين/كيلوكالورى.

اظهرت النتائج ان اضافة مسحوق بذور الرجلة يحسن معنويا اداء النمو، معامل الحالة ومعدل البقاء بزيادة مستوى بذور الرجلة فى العليقة، بينما معدل التحويل الغذائى تحسن معنويا بزيادة مسحوق بذورالرجلة فى العليقة حتى مستوى ٢%. محتوى الجسم من البروتين زاد معنويا بزيادة مسحوق بذور الرجلة فى العليقة، ولكن انخفض معنويا محتوى الجسم من الرطوبة والدهن بزيادة مسحوق بذور الرجلة فى العليقة، بينما محتوى الجسم من الرماد لم يتاثر معنويا باختلاف العليقة.

يمكننا التوصية بان اضافة ٢-٣% من مسحوق بذور الرجلة يحسن من اداء النمو، الاستفادة من الغذاء وتركيب الجسم لاسماك البلطى النيلى.