*J. Animal and Poultry Prod., Mansoura Univ., Vol.3 (6): 329 - 338, 2012*

# POSIBILITY OF USING MEDICINAL PLANTS IN FISH DIETS: IV- CAMPHOR DRIED LEAVES

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## ABSTRACT

In an indoor feeding trial for 16 weeks in plastic tanks on Nile tilapia fish fry, dietary graded levels (0, 1, and 2 %) of camphor tree leaves meal were tested for their effects on the fish performance. It was concluded that dietary inclusion of camphor tree leaves meal (particularly at 2 %) had improved significantly fish performance concerning final fish weight, weight gains (total and daily), relative growth rate, feed utilization parameters (feed and protein intakes, feed conversion, protein productive value, protein efficiency ratio, energy retention), carcass composition (protein, ether extract, energy). So, it could recommend the addition of 2 % camphor tree leaves meal to Nile tilapia fish diets, but it may need more research on the effect of such feed additive on the organoleptic test of the fish meat.

**Keywords:** Tilapia – Performance – Composition –camphor leaves.

## INTRODUCTION

Based on the existing efforts to promote sustainable aquaculture, environmental-friendly processed feeds should be addressed, developed and implemented (Frankic and Hershner, 2003). Because of the rapidly increasing of worldwide aquaculture, aquafeed's supply is less than its demand; so, many efforts are undertaken to overcome this gap. Among these efforts is evaluation of novel feed sources, such recycling some medical plants (El-Saidy and Gaber, 1997; Hassanen, 1998; Gaber, 2000; Logambal *et al.*, 2000; Abd Elmonem *et al.*, 2002; El-Komy, 2006 and Abd El-Hakim, 2008) whether to substitute one of the conventional feed stuffs in a diet or for their attractive or immunostimulatory effects.

Camphor tree (*Cinnamomum camphora* or *Eucalyptus camaldulensis*) is traditionally used against cough, asthma and congestion. Several volatile and water-soluble toxins were found in Eucalyptus tissues. Cineole and α-pinene are highly toxic terpenes. Of 10 isolated phenolic toxins, five were identified as caffeic acid, chlorogenic acid, p-coumaric acid, ferulic acid, and gallic acid. There are factors permit toxin concentrations to reach physiologically significant proportions (Anon., 1970). Potassium is an essential macronutrient in higher plants. It plays an important physiological role in stoma movements, osmoregulation, enzyme activation and cell expansion. The demand for potassium can be substantial, especially when the plant concerned is a *Eucalyptus* tree in excess of 50 m tall. Two cDNAs, *EcHKT1* and *EcHKT2*, were isolated from *Eucalyptus camaldulensis* (Fairbairn *et al.*, 2000). The osmosensing function may provide *E. camaldulensis* with a competitive advantage in maintaining $K^+$ homeostasis

under certain conditions (Liu *et al.*, 2001). The present work aimed to study the effect of dietary graded levels of green leaves meal of camphor trees on fish performance.

## MATERIALS AND METHODS

Feeding experiment was conducted to evaluate dietary graded levels of green leaves meal of camphor trees on fish performance, carcass composition and feed utilization of Nile tilapia, *Oreochromios niloticus,* fry for 16 weeks. The experimental system consisted of 9 plastic tanks (16 liter water), each tank was continuously supplied with a compressed air from an electric compressor (Shenzehe Company BS410). Dechlorinated tap water was used to change one third of the water in each tank every day. Water was aerated before be used for about 24 hours to remove chlorine.

**Experimental fish:** A group of Nile tilapia fry *O. niloticus* with an average initial body weight of 0.28 – 0.30 g was obtained from a private farm at Al-Hamoul, Kafr El-Sheikh governorate, Egypt and transported to the wet lab., then maintained in these tanks for 2 weeks before the beginning of the experiment for acclimatization purpose. The fish were fed during the acclimatization period on the basal diet (30% crude protein) at a rate of 20% of the body weight daily, at 2 times daily. The experimental treatments were tested at three tanks (replicates) for each. Fish were stoked at a density of 7 fish / tank.

**Experimental diet:** Green leaves meal of camphor trees was added at levels of 0, 1 and 2 % in Nile tilapia fish diets. All feedstuffs used in the experimental dies were purchased from the local market. The basal diet No.1 was considered as a control. Composition and chemical analysis of the basal and experimental diets are presented in Table 1. The composition of the vitamins and minerals mixture is presented in Table 2.

**Experimental procedures:** The experiment continued for 16 weeks. During the experimental period, the fish were fed the experimental diets at a rate of 20 % of the live body weight daily. The diet was introduced twice daily, at 8 a.m. and 2 p.m. The amount of food was adjusted weekly based on the actual body weight changes. Periodical samples of water were taken from each tank to determine water quality parameters. Light was controlled by a timer to provide a 14 h light: 10 h dark as a daily photoperiod.

**Analytical methods:** Samples of water from each tank were taken to determine the water temperature, pH value, and dissolved oxygen concentration according to Abdelhamid (1996). Water temperature in degree centigrade was recorded every day by using a thermometer. The pH value of water was measured daily using an electric digital pH meter (using Jenway Ltd, model 350-pH meter). Dissolved oxygen concentration was determined weekly using an oxygen meter model (d-5509). Determination of DM, CP, EE, CF, and ash in the diets and in fish body at the start and at the end of the experiment for different groups were carried out according to the methods of A.OA.C. (1990). At the end of the experiment, three fish were derived from

each group (tank) for drying at 60ºC for 48 hours and then milled through electrical mill and kept at 4°C until analysis.

**Growth performance and efficiency of feed and protein utilization:** The growth performance and feed utilization parameters were calculated according to the following equations:

**Average weight gain** (AWG, g/fish) = Average final weight (g)-Average initial weight (g).

**Average daily gain** (ADG, mg/fish) = (Average final weight (g)-Average initial weight (g)) 1000 / Time (day).

**Survival rate** (SR %) = 100 (Total number of fish at the end of the experiment / total number of fish at the start of the experiment).

**Relative growth rate** (RGR) = Average weight gain (g) / Average initial weight (g).

**Specific growth rate** (SGR, % / day) = 100 [ln $wt_1$- ln $wt_o$] /T.

**Where:** ln: Natural log. $Wt_o$: Initial weight (g), $Wt_1$: Final weight (g), and T: Time in days.

**Feed conversion ratio** (FCR) = Total feed consumption (g) /Weight gain (g).

**Protein efficiency ratio** (PER) = Body weight gain (g)/protein intake (g).

**Protein productive value** (PPV %) = 100 [Retained protein (g)/protein intake (g)].

**Energy retention** (ER %) = 100 [Retained energy (Kcal) / Energy intake (Kcal).

**Table 1: Composition (%) and chemical analysis (% on dry matter bases) of the experimental diets.**

| Ingredient | Diet No. 1 Control | Diet No.2 Camphor (1%) | Diet No.3 Camphor (2%) |
|---|---|---|---|
| Fish meal | 7 | 7 | 7 |
| Soybean meal | 50 | 50 | 50 |
| Yellow corn | 23 | 22 | 21 |
| Wheat bran | 15 | 15 | 15 |
| Camphor leave meal | 0 | 1 | 2 |
| Sunflower oil | 2 | 2 | 2 |
| Vitamins & minerals | 3 | 3 | 3 |
| Chemical analysis | | | |
| Dry matter (DM) | 90.01 | 89.87 | 89.93 |
| Crude protein (CP) | 29.61 | 29.91 | 29.31 |
| Ether extract (EE) | 4.94 | 5.02 | 5.05 |
| Ash | 4.74 | 4.61 | 4.56 |
| Crude fiber (CF) | 10.16 | 9.95 | 10.44 |
| Nitrogen free extract (NFE) | 50.55 | 50.51 | 50.64 |
| Gross energy (GE)* (kcal/100 g DM) | 420.96 | 425.63 | 421.10 |
| Protein/energy (P/E) ratio (mg CP/kcal GE) | 70.33 | 70.27 | 69.60 |
| Metabolizable energy (ME)** (kcal/100g) | 349.73 | 353.20 | 349.52 |

*GE (kcal/100 g DM) = CP x 5.64 + EE x 9.44 + NFE x 4.11 calculated according to (Macdonald *et al.*, 1973)

**ME (kcal/100g DM) = Metabolically energy was calculated by using factors 3.49, 8.1 and 4.5 kcal/g for carbohydrates, fat and protein, respectively according to Pantha (1982).

***Table 2: Contents of the vitamins and mineral mixture* (calculated for each kg of the mixture) in the diet.***

| | |
|---|---|
| **Vitamins:** | |
| A | 5.714.286 IU |
| $D_3$ | 85.714 IU |
| E | 7.143 mg |
| $K_3$ | 1.429 mg |
| $B_1$ | 571 mg |
| $B_2$ | 343 mg |
| $B_6$ | 571 mg |
| $B_{12}$ | 7.143 µg |
| C | 857 ug |
| Biotin | 2.857 mg |
| Folic acid | 86 mg |
| Pantothenic acid | 1.143 mg |
| **Minerals:** | |
| Phosphorus | 28.571 mg |
| Manganese | 68.571 mg |
| Zinc | 51.429 mg |
| Iron | 34.286 mg |
| Copper | 5.714 mg |
| Cobalt | 229 mg |
| Selenium | 286 mg |
| Iodine | 114 mg |
| **Inert essential agent:** | |
| Starch | 57 g |
| Natural. H. | 29 g |
| $CaCo_3$ | Up to 1000 g |

*: Multi Vita Co. Animal Nutrition, 6 October city, 2nd Industrial district.

**Statistical analysis:** The data were statistically analyzed using General Linear Models (GLM) procedure adapted by SAS (1996) for users guide. Means were separated using Duncan's multiple range test (Duncan, 1955).

## RESULTS AND DISCUSSION

**Water quality:** Ranges of water quality parameters measured are given in Table 3 including temperature, pH value and dissolved oxygen (DO) , being 24 – 26 °C, 7.5 – 8.5, and 5 – 6 mg/l, respectively which did not differ among treatments. Values of the measured criteria were within the suitable ranges for rearing Nile tilapia fish according to Abd El-hakeim et *al.* (2002) and Abdelhamid (2003).

**Table 3: Ranges of some water quality parameters of the experimental fish tanks**

| Parameter | Treatment | | |
|---|---|---|---|
| | Control | Camphor (1%) | Camphor (2%) |
| Temperature (°C) | 24-26 | 24-26 | 24-26 |
| PH value | 7.5 – 8.5 | 7.5 – 8.5 | 7.5 – 8.5 |
| DO (mg/l) | 5 – 6 | 5 – 6 | 5 – 6 |

**Growth performance:** Tables 4 and 5 illustrate the means of the tested growth performance parameters. The dietary inclusion of camphor leave meal (particularly at 2 % level) significantly (P≤0.05) improved each of final weight (FW), average weight gain (AWG), and average daily gain (ADG) as presented in Table 4 as well as relative growth rate (RGR) and specific growth rate (SGR) as given in Table 5 comparing with the control (free of camphor leave meal). Meanwhile, there were no significant (P≥0.05) differences among treatments in the survival rate (SR). El-Dakar *et al.* (2004a) found that 2% dietary inclusion of dried basil leaves was palatable and improved digestibility of protein and energy, so increased weight gain, SGR, feed efficiency, and PER. Additionally, El-Dakar *et al.* (2004b) reported that 2% dried marjoram leaves in the diet of hybrid tilapia fingerlings significantly enhanced all fish growth performance and feed and nutrients utilization parameters. Similar results were obtained when Abd El-Hakim (2008) fed brood stock tilapia fish on licorice or ginger included diets that improved fry performance. Since 1 % addition level led to better final weight, gain, SGR, survival and feed conversion.

**Table 4: Data* of some growth performance parameters of the experimental fish groups.**

| Treatment | I W, g / fish | F W, g / fish | AWG, g / fish | ADG, g / fish |
|---|---|---|---|---|
| Control | 0.28a | 2.00$^{c}$ | 1.79$^{c}$ | 14.92$^{c}$ |
| Camphor (1%) | 0.28a | 3.29$^{b}$ | 3.00$^{b}$ | 25.00$^{b}$ |
| Camphor (2%) | 0.29$^{a}$ | 4.39$^{a}$ | 3.98$^{a}$ | 33.17$^{a}$ |

*Means (in the same column) superscripted with different letters significantly differed (P≤0.05).
IW: initial weight, FW: final weight, AWG: average weight gain, ADG: average daily gain.

**Table 5: Means* of relative growth rate (RGR), specific growth rate (SGR) and survival (SR) rate of the experimental fish groups.**

| Treatment | RGR | SGR, %/d | SR% |
|---|---|---|---|
| Control | 8.66$^{c}$ | 1.75$^{b}$ | 100$^{a}$ |
| Camphor (1%) | 10.5$^{b}$ | 2.20$^{a}$ | 100$^{a}$ |
| Camphor (2%) | 13.42$^{a}$ | 1.38$^{c}$ | 100$^{a}$ |

*Means (in the same column) superscripted with different letters differ significantly (P≤0.05).

**Feed utilization:** Addition of camphor leaves meal significantly (P≤0.05) improved each of feed intake, feed conversion ratio (FCR), protein intake, protein productive value (PPV), protein efficiency ratio (PER), and energy retention (ER) comparing with the control (0 % camphor leaves meal) and proportional to the increase in camphor level in the diets as presented in Table 6. However, dietary inclusion of medicinal plants (garlic, El-Saidy and Gaber, 1997; onion and garlic, Zaki and El-Ebiary, 2003; *Allium sativum* and *Thymus vulgaris,* Attalla, 2009a) often increases fish performance, nutrients utilization, and chemical composition. Gaber (2000) concluded that 8 mg clove oil/100g diet significantly increased weight, length, feed efficiency, and protein and fat contents of flesh of Nile tilapia fingerlings comparing with the control. El-Dakar *et al.* (2004a) found that 2% dietary inclusion of dried basil

*leaves was palatable and improved digestibility* of protein and energy, so increased weight gain, SGR, feed efficiency, and PER. Similar results were obtained when Abd El-Hakim (2008) fed brood stock tilapia fish on licorice or ginger included diets, that improved survival rate and led to better feed utilization (to produce 1000 fry). Moreover, Attalla (2009b) mentioned also that feeding with a mixture of ginger (powder and oil extract) can promote all growth parameters and decrease mortality rate of Nile tilapia. These positive effects of most feed additives are due to their active pharmacological (medical) substances. Abdelhamid *et al.* (2004, 2006 and 2012) came to the conclusion that mallow, water hyacinth, and duck weed plants, respectively can be included in fish diets without harmful effects.

**Table 6: Means* of feed utilization parameters of the experimental fish groups.**

| Treatment | Feed Intake, g/fish | FCR | Protein Intake, g/fish | PPV,% | PER | E R,% |
|---|---|---|---|---|---|---|
| Control | 12.75$^{b}$ | 7.01$^{a}$ | 3.77$^{b}$ | 19.43$^{c}$ | 0.47$^{b}$ | 29.96$^{b}$ |
| Camphor (1%) | 14.61$^{b}$ | 4.86$^{b}$ | 4.32$^{b}$ | 29.57$^{b}$ | 0.69$^{a}$ | 48.47$^{a}$ |
| Camphor (2%) | 18.92$^{a}$ | 4.74$^{b}$ | 5.59$^{a}$ | 31.59$^{a}$ | 0.71$^{a}$ | 51.13$^{a}$ |

***Means (in the same column) superscripted with different letters significantly (P≤0.05) differ.**

**Carcass composition:** Tables 7 and 8 illustrate the data of proximate chemical analysis of the fish before and after carrying out of the experiment, respectively. At the end of the experiment, the dry matter (DM) and crude protein (CP) percentages increased but the ash content decreased comparing with the analysis before the start of the experiment. However, the dietary inclusion of camphor leaves meal at 2 % level significantly (P≤0.05) increased each of CP, EE and energy content (EC) as noticed from Table 8 comparing with the control (0 % camphor leaves meal). Table 8 presents also positive relationships between both CP and EE on one side, and between CP and ash, and between EE and EC on the other side. El-Kholy (2012) fed marjoram (*Marjorana hortensis*) or sage (*Salvia officinalis*) as feed additives and found increases in weight gain, feed efficiency and protein content in whole body composition of tilapia hybrid (*Oreochromis niloticus x Oreochromis aureus*) monosex fingerlings at levels of 150 and 300 mg/kg diet, respectively, comparing with the control. A positive correlation between crude protein and crude ash contents of Nile tilapia fish was reported also by Abdelhamid *et al.* (1995, 1997, 1998, 1999, 2000 and 2007) and El-Saidy and Gaber (2002). Eid (1995), Kobeisy and Hussein (1995), Gaber (1996), El-Saidy and Gaber (1998 and 2002) and El-Saidy *et al.* (1999) found that there was a positive correlation between crude protein and fat contents of the fish.

**Table 7: Chemical composition (% on dry matter basis) of the experimental fish groups at the start of the experiment.**

| Composition | % |
|---|---|
| DM | 18.75 |
| CP | 40.84 |
| EE | 25.81 |
| NFE | 16.21 |
| Ash | 17.14 |

**Table 8: Means* of chemical composition (% on dry matter bases) of Nile tilapia carcass as affected by the dietary treatments.**

| Treatment | DM % | Proximate analysis | | | |
|---|---|---|---|---|---|
| | | CP | EE | Ash | EC**, kcal /100g |
| Control | 72.34$^{a}$ | 56.90$^{b}$ | 15.54$^{b}$ | 10.67$^{a}$ | 554.8$^{b}$ |
| Camphor (1%) | 73.26$^{a}$ | 57.90$^{ab}$ | 16.03$^{b}$ | 9.99$^{a}$ | 564.5$^{b}$ |
| Camphor (2%) | 72.85$^{a}$ | 59.11$^{a}$ | 35.55$^{a}$ | 11.19$^{a}$ | 746.4$^{a}$ |

*Means (in the same column) superscripted with different letters differ significantly (P≤0.05).

**EC: Energy content calculated according to Macdonald *et al.* (1973)

## REFERENCES


Abd El-Hakim, A. E. (2008). Effect of type of diet on productive and reproductive performance of Nile tilapia reared on commercial scale. Ph. D. Thesis, Fac. of Agric., Fayoum Univ.

Abd El- Hakim, N. F.; Bakeer M.N. and Soltan M.A. (2002). Water Environment for Fish Culture. Deposition No.: 4774, ISBN: 977-298-228-5.

Abdelhamid, A. M. (1996). Field and Laboratorial Analysis in Animal Production. Dar Annashr for Universities, Cairo, Deposit No. 11318/1996, ISBN: 977- 5526-04-1, 680 p.

Abdelhamid, A.M. (2003). Scientific Fundamentals for Fish Production and Management, 2nd Rev. Ed., Deposit No. 15733/2003, Mansoura Univ. Press.

Abdelhamid, A. M.; Khalil, F. F. and El-Zareef, A. M. (2000). Studies on iron in Egyptian freshwater fishes, 2- Effect of vitamin C and/or vitamin A supplementation on iron utilization by tilapia (*Oreochromis niloticus*) and catfish (*Clarias lazera*). J. Agric. Sci., Mansoura Univ., 25(1): 113 – 131.

Abdelhamid, A.M.; Khalil, F. F. and Essa, M. R. (1999). Effect of graded levels of vitamins C and/or E in diets of Nile tilapia brood stock fishes (*Oreochromis niloticus*) on: 1- Growth performance, chemical composition and feed utilization. Egypt. J. Nutr. & Feeds, 2: 823 – 838.

*Abdelhamid*, A. M.; Khalil, F. F. and El-Barbary, M. I. (1997). Effect of different dietary crude protein levels supplemented with graded levels of flavomycin on growth performance of Nile tilapia fry and their utilization of different nutrients. Egypt. J. Aquat. Biol. & Fish., 1(2): 93 – 108.

Abdelhamid, A. M.; Khalil, F. F. and El-Barbary, M. I. (1998). Effect of using graded levels of gibberellic acid in diets differing in the crude protein levels on performance and chemical composition of Nile tilapia fingerlings. Egypt. J. Aquat. Biol. & Fish., 2(4): 221-233.

Abdelhamid, A. M.; El-Fadaly, H. A. and Ibrahim, S. M. (2007). Studies on integrated fish/duck production system: 1- On water quality and fish production. J. Agric. Sci. Mansoura Univ., 32: 5225 – 5244.

Abdelhamid, A. M., El-Sadaney, H.H., El-Shinnawy, M.M. and Dorra, T.M. (1995). Effects of dietary graded levels of ascorbic acid on performance and chemical composition of tilapia fingerlings. J. Agric. Sci. Mansoura Univ., 20: 2731 – 2742.

Abdelhamid, A. M.; Maghraby, N. A., Mehrim, A. I., Soliman, A. A. A. and Ali, H. M. (2012). Impact of non conventional feedstuffs on dietary composition and growth performance and nutrients utilization of Nile tilapia fish. Proc. of the 13th Sci. Conf. for Animal Nutrition, 14-17 Feb., Sharm El-Shekh, pp: 349-357.

Abdelhamid, A.M., Salem, M.F.I. and Khalafalla, M.M.E. (2006). Substitution of soybean meal by waterhyacinth hay in diets of Nile tilapia (*Oreochromis niloticus*). The 2nd Inter. Sci. Con. For Environment "Recent Environmental Problems and Social Sharement", 28-30 March, South Valley University. pp. 114 – 126 (Engormix.com Aquaculture Technical Articles, 2007, 6 p.).

Abdelhamid, A.M., Salem, M.F.I. and Tolan, A.E. (2004). Evaluation of mallow (*Malva parviflora* L.) plants as an alternative protein source for Nile tilapia (*Oreochromis niloticus*) fingerlings. J. Agric. Sci. Mansoura Univ., 29: 6899 – 6910.

Abd Elmonem, A. I.; Shalaby, S. M. M., and El-Dakar, A.Y. (2002). Response of red tilapia to different levels of some medical plants by-products: black seed and roquette seed meals. Proc. 1st Sc. Conf. Aqua., El-Arish, 13-15 Dec., pp: 247-260.

Anon. (1970). American Midland Naturalist, 83 (1): 254-282.The University of Notre Dame.

A.O.A.C. Association of Official Agricultural Chemists (1990). Official methods of analysis. 15th Ed. Published by the A.O.A.C., Benjamin Francklin Station, Washington. D.C., USA.

Attalla, R. F. (2009a).Influence of some feed additives on growth rates and physiological measurements of blue tilapia (*Oreochromis aureus*). Egypt. J. Aquatic Res., 35 (2): 231-241.

Attalla, R. F. (2009b). Growth response and physiological activities of the Nile tilapia (*Oreochromis niloticus*) fed basal diets supplemented with ginger (*Zingiber officinale*) as natural growth promoters. Egypt. J. Aqut. & Fish., 13 (4): 85-107.

Duncan, D.B. (1955). Multiple ranges and multiple F-test. Biometrics, 11: 1-42.

Eid, A. (1995). Evaluation of fish oil, corn oil, palm oil, olive oil and beef tallow singly and in combination as supplemental dietary lipid source for fingerling Nile tilapia diets. Zagazig J. Agric. Res., 22(4): 1015 – 1022.

El-Dakar, A. Y.; Hassanien, G. D., Gad, S. S. and Sakr, S. E. (2004a). Medicinal and aromatic plants as feeding attractants for fish. II. Effect of dried basil leaves on performance of hybrid tilapia, *Oreochromis niloticus x Oreochromis auraus,* fingerlings. 3rd Con. on Anim. Poul. & Fish Prod. & Health in Semi-Arid Areas, El-Arish, 7-9 Sept., pp: 265-277.

El-Dakar, A. Y.; Hassanien, G. D., Gad, S. S. and Sakr, S. E. (2004b). Medicinal and aromatic plants as feeding attractants for fish. I. Effect of dried marjoram leaves on performance of hybrid tilapia, *Oreochromis niloticus x Oreochromis auraus,* fingerlings. J. Egypt. Acad. Soc. Environ. Develop., (B-Aquaculture), 5 (1): 67-83.

El-Kholy, Kh. F. (2012). Effect of marjoram (*Marjorana hortensis*) or sage (*Salvia officinalis*) additives on growth performance and feed utilization of tilapia hybrid (*Oreochromis niloticus x Oreochromis aureus*) monosex fingerlings. J. Animal and poultry Prod., Mansoura Univ., 3 (3): 115-126.

El-Komy, H. M. A. I. (2006). Utilization of some non-conventional feedstuffs and food processing by-products in the diet of Nile tilapia. Ph. D. Thesis, Fac. of Agric., Kafr El-Sheikh Univ.

El-Saidy, D.M.S.D. and Gaber, M.M.A. (1997). Effect of different levels of dry garlic meal supplemented to the diets on growth performances, survival and body composition of Nile tilapia (*Oreochromis niloticus*) fingerlings. Annals of Agric. Sc., Moshtohor, 35 (3): 1197-1209.

El-Saidy, D. M. S. D. and M. M. A. Gaber (1998). Effects of using ascorbate polyphosphate in practical diets on Nile tilapia (*Oreochromis niloticus*) fry performances. Menofiya J. Agric. Res., 23(2): 363 – 378.

El-Saidy, D. M. S. D. and M. M. A. Gaber (2002). Optimal dietary lipid levels for growth of Nile tilapia (*Oreochromis niloticus* L.) fry. Annals of Agric. Sci., Moshtohor, 40(3): 1461 – 1473.

El-Saidy, D.M.S.D., M. M. A. Gaber, and F. I. Magouz (1999). Effect of dietary energy level on growth, feed conversion, body composition, digestibility coefficients and energy budget of Nile tilapia (*Oreochromis niloticus*). Egypt. J. Aquat. Biol. & Fish., 3(3): 159–178.

Fairbairn, D.J.; W. Liu, D. P. Schachtman, S. Gomez-Gallego, S. R. Day, and R. D. Teasdale (2000). Characterisation of two distinct HKT1-like potassium transporters from *Eucalyptus camaldulensis.* Plant Molecular Biology, 43 (4): 515-525.

Frankic, A. and Hershner, C. (2003). Sustainable aquaculture: developing the promise of aquaculture. Aquaculture international, 11: 517-530.

Gaber, M.M.A. (1996). Effect of oil sources on growth, feed conversion and body composition of Nile tilapia (*Oreochromis niloticus*). Annals of Agric. Sci., Moshtohor, 34(4): 1549 – 1562.

Gaber, M. M. (2000). Growth response of Nile tilapia fingerlings (*Oreochromis niloticus*) fed diets containing different levels of clove oil. Egypt. J. Aquat. Biol. & Fish., 4 (1): 1-18.

Hassanen, G. D. I. (1998). Lupin seed meal compared with soybean meal as partial substitutes for fish meal in gilthead sea bream (*Sparus aurata*) diets. J. Agric. Sci. Mansoura Univ., 23 (1): 141-154.

Kobeisy, M.A. and Hussein, S.Y. (1995). Influence of dietary live yeast on growth performance and some blood constituents in *Oreochromis niloticus*. Proc. 5th Sci. Conf. Anim. Nut., Ismailia, 12 – 13 Dece., pp: 417 – 425.

Liu, W.; Fairbairn, D. J., Reid, R. J. and Schachtman, D. P. (2001). Characterization of two HKT1 homologues from *Eucalyptus camaldulensis* that display intrinsic osmosensing capability. Plant Physiology, 127 (1): 283-294.

Logambal, S. M.; Venkatalakshmi, S. and Michael, R. D. (2000). Immunostimulatory effect of leaf extract of Ocimum sanctum Linn. In *Oreochromis mossambicus* (Peters). Hydrobiologia, 430: 113-120.

Macdonald, P., Edwards, R.A. and Greenhalgh, J.F.D. (1973). Animal Nutrition, 2nd Ed., Longman, London.

Pantha, B. (1982). The use of soybean in practical feeds for *Tilapia niloticus*. M. Sc. Thesis. Univ. of Stirling.

SAS (1996). SAS/STAT Guide for personal computer. SAS Inst. Cary, N. C.

Zaki, M. A. and El-Ebiary, E. H. (2003). Effect of incorporation of onion and garlic into diets on growth performance and body composition of mono-sex Nile tilapia (*Oreochromis niloticus*). Egypt. J. Aquat. Biol. & Fish., 7 (1): 113-126.

## إمكانية استخدام النباتات الطبية فى علائق الأسماك:
## ٤ – مسحوق أوراق أشجار الكافور

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فى تجربة تغذية معملية لمدة ١٦ أسبوعا فى أحواض بلاستكية على ذريعة أسماك البلطى النيلى، تم تجريب إضافة مسحوق أوراق أشجار الكافور بتركيزات متدرجة (صفر، ١، ٢ % من العليقة) لدراسة تأثيراتها على أداء الأسماك، فثبت أن احتواء العلائق على مسحوق أوراق أشجار الكافور (خاصة بالتركيز الأعلى وهو ٢ %) قد حسّن معنويا من أداء الأسماك من حيث الوزن النهائى، الزيادة فى الوزن (كلية ويومية)، معدل النمو النسبي، أوجه الاستفادة الغذائية (استهلاك العلف والبروتين، التحويل الغذائى، قيمة البروتين الإنتاجية، معدل كفاءة البروتين، تخزين الطاقة)، تركيب الجسم (محتواه من البروتين الخام والدهن والطاقة)، لذا يُنصح باحتواء علائق صغار أسماك البلطى النيلى على ٢ % مسحوق أوراق أشجار كافور، وربما يحتاج الأمر مزيد من الدراسة لمعرفة تأثير تلك الإضافة على تذوق لحوم الأسماك.

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