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EFFECT OF ADDING THREE TYPES OF PLANT OILS TO PRODUCTIVE PERFORMANCE IN DIETS OF COMMON CARP FISH *CYPRINUS CARPIO* L. REARED IN FLOATING CAGES

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Abstract

This study was conducted to find out the effect of the addition of three types of plant oils (mint, chamomile, and ginger) on productive and immune performance in common carp fish *Cyprinus carpio* L. Used 120 fish with an average weight of 250 ± 4g, randomly distributed over four treatments with three replicates, with 10 fish per replicate. Used Four treatments: the first control (T1) without additives and the second treatment (T2), adding peppermint oil by (0.5%), the third treatment (T3), adding chamomile oil by (0.5%), and the fourth treatment (T4), adding ginger oil by (0.5%). Fish were fed on experimental diets by 5% of the live weight divided into two meals per day and the trial continued for 128 days, including 8 days for the adaptation period. Measured Some growth criteria for assessing the effect of diets and Some environmental tests were taken as. The results showed significant differences between the treatments ($p<0.05$), the chamomile treatment (T3) and the mint treatment (T2) outperformed the rest of the treatments in the growth criteria as they recorded the highest weight increase rate, respectively, reaching 656g and 609g and also recorded the highest weight increase rate of Respectively 405g and 358g. Also, they recorded the highest food conversion rate (FCR), respectively, 3.0 and 3.14 gm/g weight gain and the highest food transfer efficiency rate (FCE), respectively, were 33.36 and 31.82%. They also recorded the highest daily growth rate (DGR), respectively, of 3.38 and 2.99 g/day. It recorded the highest qualitative growth rate, respectively, 1.88% and 1.80%. The conclusion of this study is that the use of oils (mint, chamomile and ginger) with a concentration of 0.5% in diets of common carp fish has improved productive performance.

***Key words**:* Fish, Mint ,Chamomile, Ginger.

Introduction

Aquaculture is the fastest growing sector in animal food production, with fish contributing about 17% of the proteins consumed by the world's population In view of this importance, global production of aquaculture has increased, reaching in 2016 (53.367) million tons, with an average of 20.3kg of fish per person per year. (FAO, 2018). However, aquaculture's growth is often associated with intensification of agriculture, which leads to overcrowding and poor water quality, And facilitate the spread of pathogens and increase disease outbreaks and, as a consequence, the occurrence of deaths (Bondad *et al.,* 2005). In order to avoid economic losses related to health deficiencies, veterinary medicines are widely used in fish farming for disease prevention and treatment. (Rico *et al.,* 2013). While the extensive use of synthetic drugs presents many imperfections for both the environment and health, and the extensive use of antibiotics has led to their accumulation in fish tissues (Cabello *et al.,* 2006). Therefore, medicinal plants can provide a cheaper and more sustainable alternative to chemotherapy in aquaculture, as it has been shown to show many vital effects such as anti-stress, And immune stimulants against parasitic, bacterial, fungi, external viruses and parasites (Reverter *et al.,* 2012). In addition, its use can reduce treatment costs and be more environmentally friendly as it is more biodegradable than synthetic molecules, It is also less likely to produce drug resistance due to the wide variety of plant extract molecules (Olusola *et al.,* 2013).

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This study aimed to know the effect of using three types of plant oils (mint, chamomile and ginger) on productive and in the common carp fish *Cyprinus carpio* L.

Materials and Methods

Zone Of Experiment And Fish

The experiment was conducted in Iraq, Dhi Qar Governorate, southeast of Nasiriyah. The site is 12 km from the center of Nasiriyah. For the period from 23/8/2019 to 12/31/2019, including an 8-day acclimatization period in floating cages located on the Euphrates River. Brought 150 common carp fish from domestic hatchers. The fish were left for 8 days in floating cages for the purpose of acclimatization before the beginning of the experiment and they were given food at 3% of the weight of the live mass and by two meals per day. Then 120 fish were selected, with an average weight of 250 ± 4g. They were randomly distributed in four treatments with three replicates and by 10 fish per repeater.

Manufacture of Diets

The diets were manufactured locally at the site of the experiment, as they were made from fodder materials available in the local market, as shown in table 1. And samples were taken from them to know the chemical composition of the diets as shown in table 2. The diets were made according to the percentage of each substance, and plant oils (mint, chamomile and ginger) were added by 0.5% for the diets to be tested. Used Imported plants oil. The material was then pressed into a 6 mm pellet by a local manufacturing machine, It was left in the sun for 12 hours, then packed in special bags of 50kg and stored in a dry place until use. The fish were fed with 5% of the live mass of the fish distributed two meals per day. The average weight of the fish was measured every two weeks to determine the daily feed amount based on 5% of its weight.

Table 1: The ingredients of the diets used in the experiment.

Percentages included in the diet (%)				Ingredient
T4	T3	T2	T1	
35	35	35	35	Soybean meal
15	15	15	15	Animal protein
17	17	17	17	yellow corn
10	10	10	10	barley
10	10	10	10	Wheat bran
10	10	10	10	Wheat flour
0.5	0.5	0.5	1	Sunflower oil
1	1	1	1	salt
1	1	1	1	Vitamins and minerals
0	0	0.5	0	Peppermint oil
0	0.5	0	0	Chamomile oil
0.5	0	0	0	ginger oil
100%	100%	100%	100%	Total

Table 2: The chemical composition of the feeds calculated on the basis of the dry matter.

Percentage	Nutrients
30.61	Crude protein
5.78	Ether extract
6.81	The fibers
7.09	Ash
50.29	Nitrogen Free Extract (NFE)
	(dissolved carbohydrates)
447.15	Metabolic energy (kilo calories) 100g

Feeding method was used by submersible pots. While the experiment was divided into four transactions in the following order: T1: Control is free of additives T2: Peppermint oil was added to the diet by 0.5%. T3: Chamomile oil was added to the diet by 0.5%. T4: Ginger oil was added to the diet by 0.5%.

Cages Manufacturing

Plastic cages are made of 0.75 inch plastic water pipes and plastic coated steel clip, the diameter of the clamp holes is 70 mm. The cage is designed with dimensions of 1×1×1 m (1 cubic meter). Fix the clamp on the tubes with plastic locks, The plastic cages were placed inside floating iron cages in the Euphrates River with dimensions of 3×3×2 meters, covered with a plastic clip and equipped with floats from (cork) The cages are 6 meters from the edge of the river.

Studied parameters

Weight Gain (W.G); Daily Growth Rate (D.G.R); Specific Growth Ratio % (SGR); Food Conversion Ratio (FCR) Food Conversion Efficiency (FCE).

Environmental parameters: Temperature, dissolved oxygen, salinity, pH, water flow velocity.

Statistical Analysis

The experiment was designed according to a complete random design (CRD), a complete random design, and the statistical analysis was carried out using the SPSS program, version 20 and the exercise for the significant differences between the treatments was tested (Duncan, 1955).

Results and Discussion

Environmental parameters

Table 3 shows the results of some environmental tests for the Euphrates River water in the cages site during

Table 3: Results of environmental tests at the experiment site.

Environmental checks					Months
Running speed cm/s	**Acidity pH**	**Salinity g/liter**	**Dissolved oxygen (DO) /mg/liter**	**Tempe-rature/ Celsius**	
18	8.1	1.86	7.0	32	September
17	8.0	1.83	7.9	29	October
20	8.05	1.77	8.6	23.1	November
19	8.2	1.67	8.9	16	December

the experiment period, as the water temperature was recorded from 16-32 degrees Celsius, while the dissolved oxygen concentration ranged between 7.0-8.9 mg/l, while the salinity of the water was from 1.67 -1.86 g/l, These results were identical to the study (Luay *et al.*, 2017). The pH value ranged between 8.0-8.2 and these results matched with a study (Taqreed *et al.*, 2017). The velocity of water flow was recorded at the experiment site as it ranged between 17-20 cm/s. These concentrations are suitable for the growth of common carp (Peteri, 2009).

Growth parameters

Final weight and weight gain

Table 4 showed significant differences ($p<0.05$) in the final weight of fish, as the highest final weight reached 656.95 g/fish in chamomile treatment (T3) followed by 609.05 g/fish in mint treatment (T2) and 592 g/Fish in the treatment of ginger (T4), while the control treatment (T1) recorded the lowest final average weight, as it reached 502 g/fish. While there were no significant differences between the two treatments (T2) and (T4). The chamomile treatment (T3) achieved the highest rate of weight gain at the probability level ($p<0.05$), as it reached 405.62 g/fish, while the mint (T2) and ginger (T4) coefficients achieved 358.72 g/fish, 342.55 g/fish respectively. The control treatment recorded the lowest weight increase rate of 251.88 g/fish. While there were no significant differences between the two treatments (T2) and (T4).

The results of the experiment came to a certain extent with the results of the experiment (Saidah *et al.*, 2017), which used chamomile powder to feed the hybrid red tilapia fish in several levels, as the results indicated the achievement of the highest final weight and an increase in weight at level 6%. The results also coincided to some extent with the results of a study (Zaki *et al.*, 2012), when chamomile oil was used by 1% in diets of tilapia, and also to some extent with the findings (Milad *et al.*, 2015) who used mint powder by 3% in Salmon diets and study (Leyciane *et al.*, 2019). When using pepper mint powder by 3% in diets of salmon and a study (Leyciane *et al.*, 2019) who used peppermint oil by 2.5% in diets of tilapia, and did not match the results of a study (Adem *et al.*, 2015). When peppermint oil was used in three levels (0.5, 1, 1.5) g/kg^{-1} in salmon diets, and the results also closely matched the results of a study (Ehsan *et al.*, 2019) on adult zebrafish *Danio rerio*, as it used three levels of ginger (1, 2, 3%) of the diet, as it obtained the highest growth rate at the level of 2%. It also correlated with the results of a study (Aline *et al.*, 2018) that had the highest growth rate when using ginger oil at a concentration of 1% in diets of tilapia (*Oreochromis niloticus*). Through the above results, the reason for the superiority of chamomile treatment may be due to the properties of chamomile, which stimulate the work of the digestive system, especially the intestine, and its appetizing effect due to its contain of anti-oxidant flavonoids, which in turn raises the immune status of fish and therefore reflects on the higher productive performance of fish (Nouri *et al.*, 2012). The reason why the treatment of peppermint (T2) is superior to that of control (T1) may be due to the effectiveness of peppermint oil to treat indigestion and spasms of the intestine and give a feeling of vigor and vitality, As well as it contains menthol with an attractive and aperitif flavour (Longe, 2005) As for the treatment of ginger (T4) more than control (T1), the reason may be due to the presence of phenolic compounds in ginger that calm the organ system and increase the efficiency of food absorption as it has appetizing properties (Maqsood *et al.*, 2011).

Food conversion Ratio (FCR) and food conversion efficiency (FCE)

Table 4: Primary weight, final weight, feed amount, and weight gain for experiment parameters (mean ± standard error).

Parameters	Treatment			
	Control T1	**Mint T2**	**ChamomileT3**	**Ginger T4**
Initial weight (IW) g/fish	250.33±0.88	250.33±0.67	251.34±0.88	249.67±0.33
Final weight (FW) g/fish	^{b}502.22±32.56	^{ab}609.05±60.05	^{a}656.95±24.57	^{ab}592.22±28.95
The amount of feed intake (FI) g/fish	959.70 ±129.28	1130.57±199.93	1217.35±82.12	1103.57±69.39
Weight gain g/fish	^{b}251.88±31.76	^{ab}358.72±60.59	^{a}405.62±24.55	^{ab}342.55±28.77

Different letters indicate the presence of significant differences within the same row at the level of significance ($p<0.05$).

Table 5 shows the results of FCR for the experiment coefficients, as the food conversion factor criterion is used to evaluate the efficiency of the feed provided to the fish. The results of the food conversion factor showed that chamomile treatment (T3) exceeded all treatments at a significant level (P<0.05). As it achieved the best food conversion rate of 3g feed/g weight gain, while the second and fourth treatments did not achieve any significant differences between them, as the treatment of mint T2 3.14 g feed/g weight gain and the treatment of ginger (T4) achieved 3.23 g feed/g Weight gain The control treatment (T1) achieved 3.8 g/weight gain.

These results coincided to some extent with the results of the study (Saidah *et al.,* 2017) that used chamomile powder in feeding hybrid red tilapia fish in several levels, as the results indicated the achievement of the highest level of FCR at the level of 2% was 3.72 g feed/g weight gain. It also correlated with the results of a study (Hayam *et al.*, 2011) that used 2% chamomile leaf powder in the diet of *Oreochromis niloticus*, The results indicated that the conversion rate and the nutritional conversion efficiency of chamomile treatment were superior to that of control at a significant level (p<0.05). The results of the superiority of the mint treatment (T2) over the control treatment (T1) were identical to that reached (Leyciane *et al.*, 2019) when using mint oil with a concentration of 0.125% in the diets of tilapia fish, as it obtained the highest average food transfer efficiency rate of 47.01%. It matched with the results of a study (Mohamed, 2017) that used mint powder with a 4% concentration in diets of tilapia. They did not match the results of a study (Adem *et al.*, 2015) that used peppermint oil in three concentrations (500, 1000, 1500) mg/kg^{-1} indiets of trout. Also, it did not match the results of a study (Suzana *et al.*, 2016) on Tambaqui fed a diet containing three concentrations of mint oil (0.5, 1, 1.5%)/kg. The results of the superiority of ginger treatment (T4) over control treatment (T1) also coincided with the results of (Mohammadi *et al.*, 2020) study when using ginger extract by 0.2% in diets of common carp fish that achieved the best conversion rate compared to the rest of the ratios and control treatment as it reached 1.32 Forage cloud/overweight cloud. It also coincided with the results of a study (Hosna *et al.*, 2014) when using ginger oil with a concentration of 1% in the diets of fingerlings of Beluga (*Huso huso*), as it achieved the best food conversion factor compared to the control treatment of 1.84 g/weight gain.

From the previous results, it is noted that the treatment of chamomile (T3) is superior to all treatments. This may be attributed to the richness of chamomile oil with polyphenol-antioxidant compounds with inflammatory-inhibiting effects as well as their participation in regulating metabolic processes inside the body thus raising the efficiency of the digestive system in the food transformation process (Zargaran *et al.*, 2014).

The results also showed the superiority of the mint treatment (T2) over the control treatment (T1). The reason for the superiority may be due to the presence of menthone substance in mint oil, which plays an important role in stimulating the intestine. Mint oil also contains antioxidants and bactericidal resistance, which increases the efficiency of the digestive system. To benefit from food (Mohaddese and Nastaran, 2014).

As for the superiority of ginger treatment (T4) over the control treatment (T1), the reason may be due to the presence of phenolic compounds in ginger that increase the efficiency of food absorption and has appetizing properties, as well as it contains natural organic substances that help in increasing growth (Maqsood *et al.*, 2011).

Daily Growth Rate (DGR) Specific Growth Rate (SGR)

It is clear from table 5 the results of the daily growth rate (DGR) of the experiment coefficients, as significant differences were found on the level of probability (p<0.05) between the treatments, and the results indicated the superiority of the chamomile treatment (T3) to the rest of the transactions Achieve 3.38 g/day, While the treatment of mint (T2) achieved 2.99 g/day and the treatment of ginger (T4) was Achieve at 2.85 g/day, while the control treatment (T1) recorded the lowest daily growth rate of 2.10 g/day. Also from table 5, the results of the Specific Growth Rate (SGR) of the experiment coefficients are clear, as significant differences were found on the probability level (p<0.05) between the treatments, and the results showed that the

Table 5: Conversion Factor, Nutritional Conversion Efficiency, and Daily and Specific Growth Rate of Experiments (Average ± Standard Error).

Parameters	Treatment			
	Control T1	Mint T2	ChamomileT3	Ginger T4
FCR/g	^{b}3.8±0.06	^{ab}3.14± 0.03	^{a}3.0±0.06	^{ab}3.23±0.09
FCE %	^{c}26.32 ±0.40	^{ab}31.82 ±0.29	^{a}33.36±0.64	^{b}30.97±0.83
DGR g/day	^{b}2.10 ±0.26	^{ab}2.99 ±0.50	^{a}3.38±0.20	^{ab}2.85±0.24
SGR %/day	^{b}1.61±0.06	^{ab}1.80±0.10	^{a}1.88±0.03	^{ab}1.78±0.04

Different letters indicate the presence of significant differences within the same row at the level of significance (p<0.05).

chamomile treatment (T3) exceeded the rest of the transactions Achieve 1.88%. While there were no significant differences between the second and fourth treatments, as the treatment of mint (T2) achieved 1.80% and the treatment of ginger (T4) 1.78%, while the control treatment (T1) achieved the lowest specific growth rate of 1.61%.

Results of the superiority of chamomile treatment (T3) with a daily and qualitative growth rate over the control treatment (T1) were somewhat identical to the results of (Saidah *et al.,* 2017) study that used chamomile powder in feeding hybrid red tilapia fish in several levels. The results indicated the achievement of the highest daily growth rate in the level of 6%, reaching 0.089 g/day and the highest specific growth rate in the level of 6%, reaching 1.0%. It also closely matched the results of a study (Yasser *et al.,* 2010) that used chamomile oil by 1% in the diets of African running fish *Clarias gariepinus*. It has a daily growth rate of 0.25 g/day. It also matched with the results of a study (Abdel-Tawab, 2010), as its results indicated the best treatment using chamomile leaf powder with a concentration of 0.5% in diets of tilapia fish.

The results also showed the superiority of the mint treatment (T2) to the control treatment (T1) in the rate of daily and specific growth, as these results coincided to some extent with the results of (Talpur, 2014) who studied the effect of adding mint extract at several levels (1, 2, 3, 4, 4). 5%) in the diets of Asian sea bass (*Lates calcarifer*), The results showed that all levels outperform the control group in the Specific Growth Rate (SGR). These results did not match the results of a study (Adem *et al.,* 2015) that used peppermint oil in three concentrations (500, 1000, 1500) mg/kg^{-1} in diets of trout fish. Daily and qualitative growth rate.

Also, the results indicated the superiority of the treatment of ginger (T4) over the treatment of control (T1) in the daily and specific growth rates, as these results coincided to some extent with the results of a study (Nya and Austink 2009) that used ginger extract at four levels (0.05, 0.1, 0.5, 1) For every 100g of feed for a period of (14) days on diets of trout *Oncorhynchus mykiss*. The results showed that all levels exceeded the levels of daily and qualitative growth over the control treatment. Also, the results coincided with the results of a study (Abdelhamid *et al.,* 2007) when using ginger extract by 0.5% in the diet provided to the *Oreochromis niloticus* fingerlings. Specific growth (SGR) was 1.09%. Also, the results coincided to some extent with the results of a study (Talpur *et al.,* 2013), which studied the effect of ginger roots in five levels (1, 2, 3, 5, 10)g per kg of feed in the feed of the popular bromon fish *Lates calcarifer*, as it got the best Specific growth rate (SGR) at levels of 5.10 gm was 1.9, 1.6%, respectively.

From the previous results, we notice the superiority of chamomile treatment (T3) to all treatments in the rates of daily and qualitative growth. The reason for the superiority may be attributed to the ability of chamomile oil to reduce stress and increase the secretion of growth hormone as well as increase vital interactions and thus increase muscle tissue building in fish (Schulz *et al.,* 1998). While the treatment of peppermint (T2) exceeds that of control (T1), the reason may be due to the positive role of the main compounds in peppermint oil (including phenolic) in improving digestion, as well as maintaining the microbial balance in the intestine (Lovkova *et al.,* 2001). As for the superiority of ginger (T4) over control (T1), it may be attributed to the effect of the biologically active compounds present in ginger directly on the health of fish by activating the immune mechanism, and polyphenols and flavonoids have anti-oxidant properties and thus work to stimulate the digestive system (Scalbert *et al.,* 2005).

Conclusion

The use of oils for plants (mint, chamomile and ginger) had a positive effect on common carp fish by increasing some production standards (weight gain, feed conversion factor, feed conversion efficiency, daily and specific growth rate).

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