

# Effect of Garlic Incorporated Feed on the Growth Performance of Freshwater Fish Tilapia Mossambica (*Oreochromis Mossambicus*)

Shailendra. S. Mangalawede

Department of Zoology, Karnatak Science College, Dharwad - 580001, Karnataka, India

Corresponding author Email: [mangalawedess\[at\]gmail.com](mailto:mangalawedess[at]gmail.com)

ORCID NO [0009 - 0002 - 7758 - 6671]

**Abstract:** The goal of current experiment was to find out the growth performance of freshwater fish, Tilapia (*Oreochromis mossambicus*), by the administration of different graded levels of garlic (*Allium sativum*) to fishes along with basal experimental diet at the concentration of 6 gm, 12 gm, 18 gm, 24 gm, and 30 gm per kilo - gramme of fish feed. Fishes were collected from Belur pond of Belur near by Dharwad of Dharwad taluk, in the state of Karnataka. After being acclimatized to laboratory condition for 14 days, the fishes were divided into six treatment groups, designated as group A, B, C, D, E, and F. Prior to garlic feed being introduced, the weight and length of each fish was recorded. Fish feed was administered twice in a day. All fish groups were fed with garlic feed at different concentrations. Fish growth performance was determined by measuring the fish length (cm) and weight (gm) (morphometry) every fifteen days. The findings demonstrated that the administration of garlic feed to fishes significantly affected the absolute growth and length of fish. It was also noted that the growth and length of fishes was increased in tandem with the concentration of the garlic feed. Based on this study, it was concluded that administration of garlic in fish feed and feeding of such feed to fishes help to increase both weight and length of fishes.

**Keywords:** Garlic (*Allium sativum*), Tilapia, Immunostimulant, Morphometry

## 1. Introduction

In the present days, aquaculture fish production has significantly increased but number of problems arising during the production of fish in intensive fish culture practices. The major problem is the production of unhealthy fish because fish are affected by a number of diseases. [1] To improve the production of healthy fish, a number of alternatives are being used in the present day. These include the use of fish vaccines and probiotics [2] and immunostimulants [3]. Continuous use of fish vaccines, antibiotics, and chemotherapeutics to prevent fish diseases may generate the risk of the development of resistant pathogens, bio accumulation, and water pollution [1]. The purchase of commercial vaccines is very expensive for fish farmers [4]. In the present situation, due to all these problems, various herbs and spices are being used for fish culture as growth promoters and immunostimulants [5]. The use of natural herbs has been reported to increase ingestion rates in fish and have organoleptic properties without any side effects on fish [6]. Several antibiotics are commonly used as growth promoters in fish culture and also to maintain the health of fish. Studies on the application of such immunostimulants and growth promoters were done by some investigators in Nile tilapia (*Oreochromis niloticus*) and some carps [7]. Regular use of antibiotics and chemotherapeutics increases the risk of the development of resistant pathogens and the problem of drug residue in treated fish. Therefore, the use of natural immunostimulants seems to be an alternative method to control fish diseases [8] and [9]. It was reported that garlic (*Allium sativum*) was used as a growth promoter in Nile tilapia (*Oreochromis niloticus*) [10]. It has been reported that dietary garlic (*Allium sativum*) acts as a growth promoter in Nile tilapia (*Oreochromis niloticus*). It improves weight gain and feed

intake [11]. The use of natural phytoadditives does not pose any side effects on the fish and water environment [12]. Garlic is found to have antibacterial, antiviral, and anti-fungal properties [13]. Garlic contains sulphur - containing compounds such as allin, diallyl sulphides, and allicine [14], [27]. Garlic can control the number of pathogens like bacteria and fungi and increase fish health [25], [15]. According to some reports, garlic acts as hypolipidemic [16], has antimicrobial properties [17], and has an insecticidal nature [18]. Garlic (*A. sativum*) contains several sulphur compounds, many enzymes, and minerals like calcium, iron, zinc, magnesium, potassium, and copper. Garlic also contains some vitamins like Vitamin A, B, and C. [19], and garlic also contains a number of amino acids like aniline, glycine, proline, glutamine, lysine, and histidine [20].

Garlic acts as an immunostimulant in fish [21]. Garlic has the ability to reduce plasma sugar levels in fish [22]. Therefore, this experimental work aimed to investigate the effect of different concentrations of garlic (*A. sativum*) on the growth performance of Tilapia fish (*Oreochromis mossambicus*).

## 2. Materials and Methods

Tilapia (*Oreochromis mosambicus*) fish were collected from Belur pond in Dharwad taluka, Dharwad district, Karnataka State, India. These fish were placed in fish ponds and acclimatized to laboratory conditions for 14 days. [19]. During acclimatization period, the fish were fed a normal feed of wheat flour crystals. All fish were fed daily at 9: 00 a. m. and 17: 00 a. m. [23]. The water in the fish pond was changed every two days in order to remove faecal matter and maintain proper oxygen in the water [12].

**Preparation and formulation of experimental diets:**

*Allium sativum* (garlic) was purchased from the local Dharwad market in Karnataka, India. Garlic peels were separated from garlic bulbs. The peels were washed cleanly in filtered water and dried in an oven, maintaining a temperature of 50 °C for 14 hours [6]. Dried garlic peels were made into powder using a grinder. Then the garlic powder was properly mixed with fish feed at concentrations of 0 g (control), 6 g, 12 g, 18 g, 24 g, and 30 g/kg. The fish feed prepared contained groundnut oil cake (280 g), soyabean meal (200 g), rice gramme (300 g), fish meal (200 g), multivitamin and mineral tablets (20gms). The dry ingredients were mixed properly with hot water and boiled for 10 minutes. The dough was pelleted, dried at room temperature for 48 hours, and stored in airtight containers. Boiled dough was cooled [1]. The following concentration of fish feed was prepared and used for the present investigation. Aquariums were marked as A, B, C, D, E and F.

A (control) - Only fish feed (Prepared feed pellets)

B - Fish feed + 6gms of garlic powder

C - Fish feed+ 12gms of garlic powder

D - Fish feed+ 18gms of garlic powder

E - Fish feed+24gms of garlic powder

F- Fish feed+ 30gms of garlic powder

**3. Experimental Design**

The experiment was carried out in six groups with three replicates; group A was taken as the control. Each aquarium contained 10 fish. Before the introduction of fish into the aquarium, the weights and length of all fish were taken, and the average weight was recorded, which was taken as the initial average weight of fish in group A. The water level in each aquarium was maintained throughout the experiment. The fish feed was given to each group of fish twice a day. The growth performance of these fish was analysed every 15 days. Growth performance was calculated in terms of weight and length (% age). The growth performance of fish was calculated by taking the initial and final weight (gm) and length (cm). The growth rate was calculated using the following formulas [12].

Weight gain in fishes (%)

$$= \frac{\text{Final average weight} - \text{Initial average weight} \times 100}{\text{Initial weight}}$$

Length gain in fishes (%)

$$= \frac{\text{Final average length} - \text{Initial average length} \times 100}{\text{Initial length}}$$

**4. Results and Discussion**

The growth performance of fish for 45 days of the experiment in both control and garlic feed - treated fish was observed and shown in Table 1. The present investigation has shown that the body weights of the fish increased with increasing garlic concentration. But the weight of fish in aquarium A (control) was not drastically changed. It was observed that the average initial weight of fish in aquarium A was 8.40±0.52 gm before treatment with garlic feed. And the final weight of fish in the aquarium was 14.79±1.06 gm after the end of the treatment for 45 days; hence, an average

increase in weight was observed of 5.39 ±0.65 gm. Fishes in aquarium B fed with a garlic concentration of 6 g/kg fish feed were observed to have an average weight of 7.82±0.88 gm. It was observed that the average initial weight of fish in aquarium B was 8.52±0.71 gm before treatment with garlic feed. It was recorded that the average final weight of fish in B was 16.34±1.81 gm after the end of the treatment for 45 days; hence, an average increase in weight was observed of 7.82±0.88 gm. And the average initial weight of fish in aquarium C was 8.20 ±0.42 gm before garlic feed treatment, and the average final fish weight recorded after garlic feed for 45 days was 16.13± 1.65gm. The average increase in the weight of fish in aquarium C was recorded at 7.93±0.76 gm. In aquarium D, the average initial weight of fish was 8.60±0.46 gm before garlic feed treatment, and the average weight increased on the 45th day to 17.98±1.98gm. The average fish weight in aquarium D increased to 9.38 ±0.87 gm. The average initial weight of fish in aquarium E was recorded at 8.50 ±0.61gm before garlic treatment. And the average final weight was recorded at 17.92± 2.09 gm after treatment for 45 days. Hence, the average increase in the weight of fish in aquarium E was 9.42±1.25 gm. Fish with aquarium F fed with garlic concentrations of 30 g/kg fish feed were observed to have an average weight gain of 10.2±1.94 gm. It was observed that the average initial weight of fish in aquarium F was 8.62±0.65 gm before treatment with garlic feed. It was recorded that the average final weight of the fish was recorded at 18.82± 2.87g after the end of the treatment for 45 days, i. e., an average increase in the weight was observed 10.2±1.94 gm. The length of the fish was observed to increase with the concentration of garlic feed. The length of the fish in aquarium A was not drastically changed. In group A, at the beginning of the experiment, i. e., the 1<sup>st</sup> day, the average length of the fish recorded was 2.37±0.32cm. At the end of the experiment, on the 45<sup>th</sup> day, it was recorded at 3.96±1.47 cm. The average increase in the length of fish in aquarium A recorded was 1.59±0.21 cm. In aquarium B, the average initial length of fish recorded was 2.42±0.86cm at the beginning of the experiment, and the average length recorded on the 45<sup>th</sup> day was 4.03±1.98cm. Hence, the average increase in fish length in aquarium B recorded was 1.61±0.76 cm. In aquarium C, the initial average length of fish was 2.31±0.32 cm, and the average final length at the end of the 45<sup>th</sup> day recorded was 4.19±1.22 cm, hence the average increase in fish length recorded in aquarium C was 1.88±0.33 cm. In aquarium D, the initial average length of fish recorded was 2.56± 0.91cm, and the average length at the end of the 45th day was recorded as 4.94±1.86 cm. The average increase in fish length in aquarium D was recorded at 2.38 ±0.86cm. In aquarium E, the average initial fish length was 2.43±1.26cm and 5.02±1.23 cm after garlic feed treatment for 45 days; hence, the average increase in fish length recorded in aquarium E was 2.59±0.92 cm. In aquarium F, the initial average length of fish was 2.69±1.43 cm, and the average final length at the end of the 45<sup>th</sup> day recorded was 5.92±1.53 cm, hence the average increase in fish length recorded in aquarium F was 3.23±0.95 cm. Hence, it was observed that an increase in the concentration of garlic feed may increase the length and weight of fish. Findings of the present investigation follow the findings of D. vigneshpriya et al. (2016), who studied the effect of garlic and onion - incorporated feed on the Tilapia

(*Oreochromis mossambicus*), [24] who worked on the effect of garlic (*Allium sativum*) on the growth and hematological parameters of *Clarius gariepinus*, [19], who worked on the short - term evaluation of graded levels of dietary garlic powder as a growth promoter on growth, survival, and feed

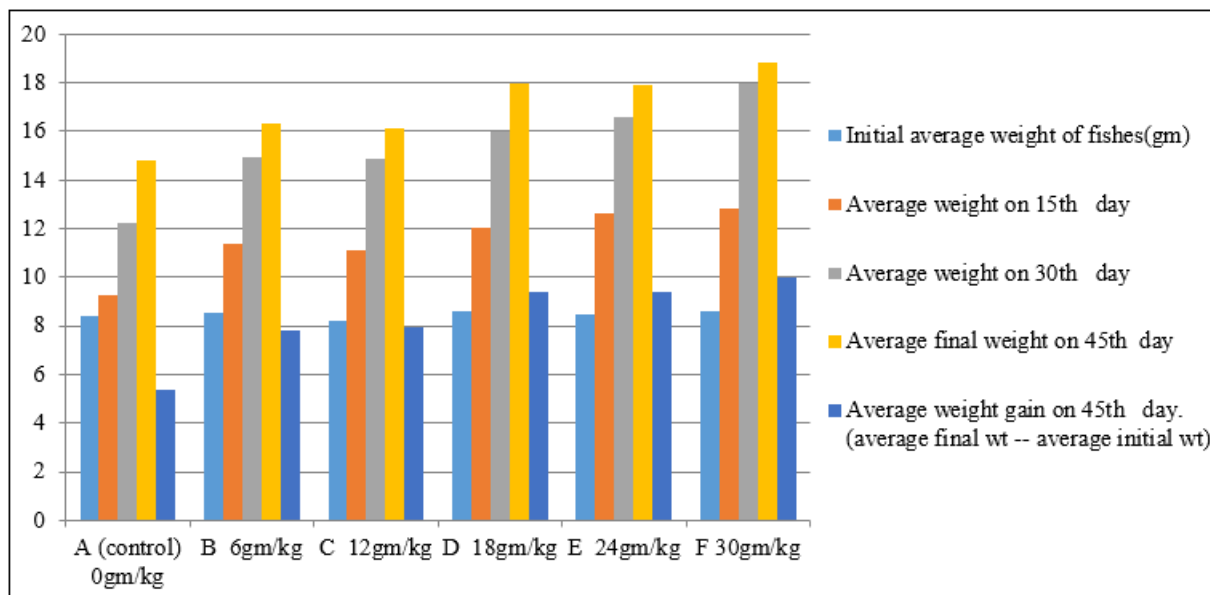
utilisation of Redbelly Tilapia *zillii*. The present work also follows the findings of Jebaraj Felicitta (2019) [23], who worked on *Oreochromis mossambicus*, and Rania Mahmoud et al. (2019) [26], who worked on Nile Tilapia (*O. niloticus*).

**Table 1:** Effect of Garlic on weight (gm) of fish Tilapia (*Oreochromis mossambicus*)

Garlic feed gm/kg	Initial average weight of fishes (gm)	Average weight on 15 <sup>th</sup> day	Average weight on 30 <sup>th</sup> day	Average final weight on 45 <sup>th</sup> day	Average weight gain on 45 <sup>th</sup> day. (average final wt - average initial wt)
A (control) 0gm/kg	8.41±0.52	9.28±1.12	12.2±1.54	14.79±1.06	5.39±0.65
B 6gm/kg	8.52±0.71	11.35±1.60	14.92±1.96	16.34±1.81	7.82±0.88
C 12gm/kg	8.20±0.42	11.12±1.21	14.88±1.76	16.13±1.65	7.93±0.76
D 18gm/kg	8.60±0.46	12.04±1.78	16.02±2.06	17.98±1.98	9.38±0.87
E 24gm/kg	8.50±0.61	12.64±1.16	16.56±2.81	17.92±2.09	9.42±1.25
F 30gm/kg	8.62±0.65	12.82±1.29	17.98±2.13	18.82±2.87	10.02±1.94

**Table 2:** Effect of Garlic on Length (cm) of fish Tilapia (*Oreochromis mossambicus*)

Garlic feed gm/kg	Initial average length of fishes (cm)	Average length on 15 <sup>th</sup> day	Average length on 30 <sup>th</sup> day	Average final length on 45 <sup>th</sup> day	Average final length gain on 45 <sup>th</sup> day (average final length - average initial length)
A (control) 0gm/kg	2.37±0.32	2.91±0.66	3.17±1.87	3.96 ±1.47	1.59±0.21
B 6gm/kg	2.42±0.86	3.18±1.28	3.61±1.22	4.03±1.98	1.61±0.76
C 12gm/kg	2.31±0.32	2.99±1.34	3.87±1.98	4.19±1.22	1.88±0.33
D 18gm/kg	2.56±0.91	3.18±1.43	4.02±1.36	4.94±1.86	2.38±0.86
E 24gm/kg	2.43±1.26	3.92±1.54	4.22±1.54	5.02±1.23	2.59±0.92
F 30gm/kg	2.69±1.43	4.28±1.29	4.96±1.79	5.92±1.53	3.23±0.95



**Figure 1:** Effect of Garlic on weight of fish Tilapia (*Oreochromis mossambicus*)

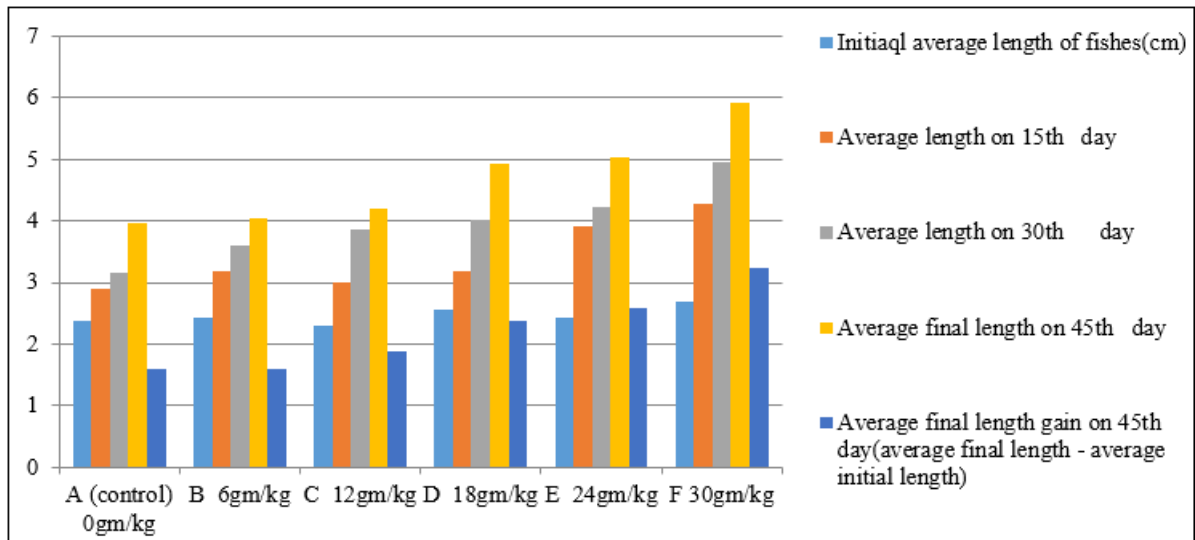


Figure 2: Effect of Garlic on length (cm) of fish Tilapia (*Oreochromis mossambicus*)

## 5. Conclusion

In the present investigation, it was observed that feeding different concentrations of garlic feed to fish affected both the weight and length of *Tilapia mossambica* fish. It was observed that, as the concentration of garlic increases, both the weight and length of fish increase. It was proven that, in aquaculture, garlic feed can be given to fish in order to increase their weight and length. Garlic (*Allium sativum*), in this investigation was considered one of the growth promoters for fish.

## Acknowledgments

The authors express their profound gratitude to the Chairman and all colleagues of the Department of Zoology, Karnatak Science College, Dharwad - 580001, Karnataka, India for providing an instrumental facility for the smooth conduction of research work.

**Conflict of interest:** The authors have declared no conflict of interest.

## References

- [1] K. Thanikachalam, M. Kasi, X. R. Rathinam, Effect of garlic peel on growth, hematological parameters and disease resistance against *Aeromonas hydrophila* in African catfish *Clarias gariepinus* (Bloch) fingerlings, *Asian Pacific Journal of Tropical Medicine* 3 (2010) 614 - 618.
- [2] F. J. Gatesoupe, The use of probiotics in aquaculture, *Aquaculture* 180 (1) (1999) 147 - 165.
- [3] J. Jian, Z. Wu, Influences of traditional Chinese medicine on non - specific immunity of Jian Carp (*Cyprinus carpio* var. Jian), *Fish & Shellfish Immunology* 16 (2) (2004) 185 - 191.
- [4] L. Ardó, G. Yin, P. Xu, L. Váradi, G. Szigeti, Z. Jeney, G. Jeney, Chinese herbs (*Astragalus membranaceus* and *Lonicera japonica*) and boron enhance the non - specific immune response of Nile tilapia (*Oreochromis niloticus*) and resistance against *Aeromonas hydrophila*, *Aquaculture* 275 (1) (2008) 26 - 33.
- [5] L. İrkin, M. Yiğit, S. Yilmaz, M. Maita, Toxicological Evaluation of Dietary Garlic (*Allium sativum*) Powder in European Sea Bass *Dicentrarchus labrax* Juveniles, *Food and Nutrition Sciences* 05 (2014) 989 - 996.
- [6] O. Ajiboye, A. Yakubu, T. Adams, A Perspective on the Ingestion and Nutritional Effects of Feed Additives in Farmed Fish Species, *World Journal of Fish and Marine Sciences* 4 (2012).
- [7] H. A. M. Essa aa., Maha. M., Marzouk M S, Effect of virginiamycin on performance and susceptibility of *O. niloticus* to *A. hydrophila* infection, *J. Egypt Vet. Med. Ass.*, 55 (1995) 109 - 21.
- [8] J. Raa, The use of immunostimulatory substances in fish and shellfish farming, *Reviews in Fisheries Science* 4 (3) (1996) 229 - 288.
- [9] S. S. Rashatwar, R. Ilyas, Effect of chronic herbicide intoxication on in vivo activities of certain enzymes in the liver of freshwater fish *Nemachelius denisonii* (Day), *Toxicology Letters* 16 (3) (1983) 249 - 252.
- [10] F. o. A. Abou - zeid SM. The effect of some medical plant on reproductive and productive performance of Nile tilapia fish. Cairo: Cairo University, 2002.212p. [Ph. D. Thesis].
- [11] N. Abdel - Hakim, M. Lashin, A. Ashry, A. L. D. Al - Azab, Effect of fresh or dried garlic as a natural feed supplement on growth performance and nutrients utilization of the Nile Tilapia (*Oreochromis niloticus*), *Egyptian Journal of Aquatic Biology and Fisheries* 14 (2010) 19 - 38.
- [12] D. Vigneshpriya, N. Krishnaveni, Effect of garlic and onion incorporated feed on the growth and nutritional status on the fresh water fish Tilapia, *Oreochromis mossambicus* (Peters, 1852), *International Journal of Fisheries and Aquatic Studies* 4 (2016) 253 - 257.
- [13] A. Diab, S. Aly, G. John, Y. Abde - Hadi, M. Fathi, Effect of garlic, black seed and Biogen as immunostimulants on the growth and survival of Nile tilapia, *Oreochromis niloticus* (Teleostei: Cichlidae), and their response to artificial infection with *Pseudomonas fluorescens*, *African Journal of Aquatic Science - AFR J AQUAT SCI* 33 (2008) 63 - 68.
- [14] H. Amagase, J. A. Milner, Impact of various sources of garlic and their constituents on 7, 12 -

- dimethylbenz [a]anthracene binding to mammary cell DNA, *Carcinogenesis* 14 (8) (1993) 1627 - 31.
- [15] M. Corzo - Martínez, N. Corzo, M. Villamiel, Biological properties of onions and garlic, *Trends in Food Science & Technology* 18 (12) (2007) 609 - 625.
- [16] H. Sumiyoshi, [New pharmacological activities of garlic and its constituents], *Nihon Yakurigaku Zasshi* 110 Suppl 1 (1997) 93P - 97P.
- [17] M. Kumar, J. S. Berwal, Sensitivity of food pathogens to garlic (*Allium sativum*), *Journal of applied microbiology* 84 (2) (1998) 213 - 5.
- [18] B. H. Wang, K. A. Zuzel, K. Rahman, D. Billington, Protective effects of aged garlic extract against bromobenzene toxicity to precision cut rat liver slices, *Toxicology* 126 (3) (1998) 213 - 222.
- [19] O. Ajiboye, A. Yakubu, J. O. Simpa, S. A. Balogun, Effect of Garlic - Supplemented Diets on Growth Response, Survival, Nutrient Utilization and Body Composition of Monosex *Tilapia zillii*, *World Journal of Fish and Marine Sciences* 8 (2): 115 - 122, 2016 8 (2016) 115 - 122.
- [20] P. A. Josling, 2005, *The heart of garlic nature's aid to healing the human body*, HEC Publishing, Chicago Illinois, pp.20.
- [21] W. Lewis, & Elvin - Lewis, M. (2003). *Medical Botany: Plants affecting human health*. (2nd ed.). New York. Wiley. p.70
- [22] C. G. Sheela, K. T. Augusti, Antidiabetic effects of S - allyl cysteine sulphoxide isolated from garlic *Allium sativum* Linn, *Indian journal of experimental biology* 30 (6) (1992) 523 - 6.
- [23] J. Felicitta, R. Manju, R. Jeyapaul, S. Thuraisami, R. Nagarajan, G. Chelladurai, Effect of different concentrations of some phytoadditives (*Allium sativum* and *Allium cepa*) on growth, survival and hematological parameters in *Tilapia (Oreochromis mossambicus)* juveniles, (2019).
- [24] A. Nwabueze, The Effect of Garlic (*Allium sativum*) on Growth and Haematological Parameters of *Clarias gariepinus* (Burchell, 1822), *Sustainable Agriculture Research* 1 (2012).
- [25] Jebaraj, Felicitta, Ronald Jeyapaul: Effect of different concentrations of some phytoadditives (*Allium sativum* and *Allium cepa*) on growth, survival and hematological parameters in *Tilapia (Oreochromis mossambicus)* juv. . . publication at: <https://www.researchgate.net/publication/335976924>
- [26] RaniaMahmoud1, AbeerAziza1\*, BasmaMarghani2, RashaEltayshInfluenceofGingerandGarlicSupplementation on Growth Performance, Whole Body Composition and Oxidative Stress in the Muscles of *Nile Tilapia (O. Niloticus)* *Advances in Animal and Veterinary Sciences* May 2019 | Volume 7 | Issue 5 | Page 397
- [27] Augusti, K. T. and Mathew P. T., 1974, Lipid lowering effect of allicin (diallyl disulphide - oxide) on long term feeding to normal rats, *Experientia*, 30: 468 - 470. <http://dx.doi.org/10.1007/BF01926297> PMID: 4833660