

# Health of Fishes enhanced by the Thymol

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**ABSTRACT:** *The thymol molecule is a food additive used to improve the efficiency of growth, development and feeding by enhancing digestive secretion and stimulating the digestive system's structure and work. In animal rations, the main application of thymol essential oil is used, especially as a natural diet additives to reduce harmful chemicals in a wide variety of animal species. In addition to reducing the problems of many animal diseases like cancer and certain other disorders, Thymol essential oil plays a key role in improving the nutritional bioavailability, reproductive and productive efficiency, overall fitness and immunity of animals. These functions can be due to the capacity of thymol to associate with cellular bioactive systems as anticancer, antimicrobial, antiviral, antioxidant, immunomodulators, anti-inflammatory and antispasmodic factors by blocking free radicals and toxic constituents and its ability to manipulate intestinal microbiota equilibrium, improved digestion, metabolism and absorption. The chemical composition and natural origins, physical properties and functional applications of thymol in fish feeding are elucidated by this study.*

**Keywords:** *Antioxidant, Antiviral, Disease Resistance, Meat quality, Thymol, Health care.*

## INTRODUCTION

Thymol is a natural monoterpene present in certain medicinal plants and essential oils, called 2-isopropyl-5-methylphenol (EOs). Almost one-third of Trachyspermumcopticum oil and seven percent of the phenolic oil compounds derived from Coleus aromaticus are made. Thyme is the primary component of thymol and has been recorded to be located mainly in the western Mediterranean region of Europe [1]. The antifungal, antispasmodic, antiseptic, carminative, expectorant, sedative, antiviral, anti-helminthic, antioxidant, diaphoretic and antimicrobial properties of this plant were used. In addition, thymol has a large spectrum of fungicidal effects towards certain forms of moulds such as Ulocladium, Penicillium, Alternaria, Aspergillus, Absidia and Mucor, Rhizopus and TrichodermaChaetomium and Cladosporium, it was theorised[2].

Thymus species have also been used to cure skin and rheumatic diseases by external use of baths. Moreover, thyme oils have been stated to be superior to other herbal EOs in terms of value and usage as preservatives and antioxidants in the agriculture and food industries. Some studies have been conducted on the use in small and large animal diets of certain herbs or their derivatives/extracts, such as cold pressed oil, essential oil or effective components, such as resveratrol, carvacrol, curcumin and thymol, which improved development, immune functions, antioxidant indices, meat quality and lowered mortality rates. This paper explores many key elements, particularly practical applications and the successful role of thymol essential oil (TEO) in the development and health of fish[3].

Thymol is an essential oil that has been derived from many plants, including Origanumdictamnus, Thymus glandulosus, Origanumvulgare, Thymus vulgaris, Monardafistulosa, Thymus zygis, Thymus hyemalis, Origanumcompactum and Origanumonites. In addition, the Monardadidyma wildflowers and bee balms of North America are common sources of thymol essential oil[4].

## ANTIOXIDANT ACTIVITY AND FREE RADICALS SCAVENGING

Safeguarding animals and their products from oxidation is the primary area of operation of natural products. TEO dietary supplementation can boost antioxidant ability in Nile tilapia, where supplemental TEO (1 and 2 mL/kg diet) gradually decreased malondialdehyde (MDA) formation and enhanced tissue glutathione reductase (GR) and higher blood catalase function. Likewise, studies showed that the dietary addition of thymol and carvacrol decreased the development of Oncorhynchusmykiss fillet MDA relative to control fish. The dietary inclusion of thyme powder (2%) has recently been reported to be a viable candidate for the restriction of compromised immunity in response to lambda-cyhalothrin as an insecticide agent in Nile tilapia aquaculture.

In comparison, the possible role of thyme oil in modulating the adverse effects of thiamethoxam on African catfish has been evaluated. It hypothesized that, in addition to its strong antioxidant and anti-apoptotic impact, fish feeding with 500 ppm thymol oil in feeds increased the number of proliferating cell

nuclear antigen (PCNA) and caspase-3 immunopositive splenocytes. Furthermore, in order to counteract the enhanced oxidative damage induced by exposure to lambda-cyhalothrin, the antioxidative potential of fish (*Oreochromis niloticus*) has been strengthened. The relaxing influence of phytochemicals (flavonoids and phenolic compounds) and minerals like manganese (Mn), which is a superoxide dismutase (SOD) enzyme cofactor, can be due to this antioxidant activity [5]. The detrimental effects of large doses of oxytetracycline on the antioxidant mechanism were greatly counteracted by thyme extracts revealed that thyme extract activated an antioxidant protection to turn the reactive oxygen species into stable constituents to defend the biological constituents from oxidation. Thyme oil or its constituents (thymol and carvacrol) substantially improved the production of glutathione peroxidase (GPx) and SOD in rainbow trout, but declines the activity of glutathione S-transferase, catalase and glutathione reductase [6].

#### *Antiviral activity*

Due to their possible antiviral benefits, like EOs or bioactive elements of some medicinal plants, herbal plants and their derivatives have been used. In contrast to its antibacterial and antifungal acts, it was stated that the use of EOs like thymol may function as an antiviral agent. They claimed that the virus particles were deactivated by the *Carum copticum* oil and the adsorption of the virion to host cells was forbidden. Monoterpenes and thymol oil were both able to inhibit roughly 80% of herpes simplex virus (HSV) and minimise 96% of viral infectivity. EOs, like thymol, also reported virucidal acts with the relevance of low toxicity relative to the antiviral effects of medications. It has been said that antiviral agents can do their job in one of two ways:

- (1) To prevent DNA or RNA formation
- (2) Viral replication elimination.

**Impact of thymol on immunity** One of the key purposes of fish development is to boost the immune system so that pathogens and diseases are minimised and prevented. The causes of immunodeficiency may be the abuse of antibiotics as therapy or development boosters, vaccine malfunction, and diseases with immune suppressive illnesses. Through using immune enhancers such as medicinal plants and their equivalents, the possibility of infectious diseases may be reduced. It was recorded that the mixture of garlic and thyme oil in rainbow trout diets improved the lifespan for thyme-garlic therapy from 5 weeks in the control group to seven weeks by decreasing thiobarbituric acid (TBA) and total volatile specific nitrogen values. The antioxidant benefits of thymol in *Latescalcarifer* fillet, Asian sea bass, fresh cod hamburgers, fresh Mediterranean sword fish fillets and bluefish, *Pomatomus saltatrix* fillet, have been reported in numerous experiments [7].

In addition, with the addition of thymol, it was found that campylobacter numbers were reduced by 0.5 percent. Any common fish pathogenic bacteria such as *Vibrio harveyi*, *V. parahaemolyticus*, *Streptococcus iniae*, *Lactococcus garvieae*, *Edwardsiella tarda*, *salmonicida*, *Aeromonas salmonicida* subsp. *masoucida*, *A. hydrophila*, *A. salmonicida* subsp. *V. anguillarum* and *V. vulnificus* have been reported to have antibacterial activity of thymol in *in vitro* conditions. TEO diet supplemented also can enhance the immune state of fish where the 1 and 2 mL/kg dietary usage of TEO has increased lysozyme production and immunoglobulin M (IgM) and immunoglobulin G (IgG) levels in Nile tilapia. In the same sense, the use of EOs (thymol and carvacrol) at 200 mg/kg increased tilapia plasma lysozyme activity and phagocytosis activity of head kidney macrophages, and recorded an immunostimulatory effect compared with control. The use of EOs in germ-free zebrafish at 2 and 20 mg/L for a single day increased interleukin-1b (IL1b) and Claudin1 expression, accordingly [8]. Important upregulation in the expression of immune-related genes like complement component 3 and differentiation cluster 4, lysozyme and interleukin-1 beta was observed when thymol oil was applied to the basal rainbow trout diet relative to the control sample. For 45 days, 1 percent thyme supplementation as a feed additive increased the lysozyme and phagocytic behaviors and also the immunocompetent cell population.

#### *Meat quality*

The oxidative mechanisms in meat products are linked to the discoloration of meat, where lipid oxidation creates prooxidants that can react with oxymyoglobin, contributing to the formation of methemoglobin. Utilizing antioxidants in livestock diets, several research have indicated a reduction in colour deterioration in red meat. In terms of enhancing meat consistency, the use of natural additives incorporating bioactive

molecules in diets has shown positive results. Dietary supplementation with various natural antioxidants (butylated hydroxytoluene, rosemary extract, carvacrol and thymol oil at 200, 600, 500 and 500 mg/kg diets, respectively) was tested in physical-chemical, microbiological and sensory studies of golden bream meat held for 14 days at 4 ° C. Findings showed that dietary phytochemicals greatly changed the colour parameters showing a lightening of the fillets colour during storage. In comparison, thymol oil supplementation dramatically decreased microbial growth, water keeping capacity, eye shape score and consistency index values throughout storing on ice relative to other therapies. They proposed that thymol may trigger the formation of Gram(-) bacteria and lipopolysaccharides to damage the cell membrane. In comparison, 1.2 percent thyme oil mixtures with 500 or 1000 IU nisin g-1 diets demonstrated the most effective control for inhibiting *L. Monocytogenes* are retained for 6 days in minced fish. This may be due to improving the inhibitory function of thymol oil in the fried beef, providing antilisterial practices [9].

#### Disease resistance

Best survival rate (31.58%) for trout fish with virulent strain A. Compared to power, hydrophila was found in fish feeding with dietary thymol oil inclusion (0.5 mL/kg feed). The dietary inclusion of blended thyme oils and fennel oil for 21 days could improve the tolerance of rainbow trout to infection with *Yersinia ruckeri* by enhancing their immune status. In another trial, after fish were confronted with *S. Iniae*, Tilapia fed 1 percent thyme contributed to a substantial increase in the survival rate (78 percent vs 39 percent). Upon being threatened with *Saprolegnia* spp., the same findings were found in carp fish, reflecting the anti-fungal and immunostimulant function of thymol as a fish feed additive. Thymol is commonly thought to be a safe way to improve the susceptibility of certain pathogens to diseases. Since contamination with *A. hydrophila*, feeding catfish with 1 percent thyme added to the basal diet decreased the mortality rate by 40 percent. In order to investigate the possible application of nanotechnology in fish farming, the effectiveness of microencapsulated TEO in mitigating the harmful effects of some shrimp viral diseases has been measured. They found that 1% of TEO treated shrimps showed no medical signs of illness with the white spot syndrome virus (WSSV) and their survival rate was greater than that of other therapies. In the shrimp farm, thus, the addition of 1 percent TEO tended to fight against this infection [10].

### CONCLUSION

The use of TEO as a feed additive has beneficial effects on growth rate, feed effectiveness, digestion and absorption of nutrients, antioxidant indices, immune response and meat quality, this analysis stated. In comparison, TEO has operations that are antimicrobial, anti-inflammatory, antispasmodic, anticancer and antiviral. In fish meat, TEO is also useful in reducing lipid peroxidation. In fish farms, exploration of TEO mechanisms of action such as dietary, pharmacological, biology and medical benefits can play a significant role.

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