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Review on Seaweed as Supplement Fish Feed

Mona M Ismail*

Taxonomy and Biodiversity of Aquatic Biota, National Institute of Oceanography and Fisheries, Egypt

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Corresponding author: Mona M Ismail, Taxonomy and Biodiversity of Aquatic Biota, Marine Environmental division, National Institute of Oceanography and Fisheries, Alexandria, Egypt

Abstract

The review briefly describing the importance of macroalgae "seaweed" as renewable source of fish feed. Fish aquaculture costs have including investment and operational costs including feed, energy, labor, fuel, oxygen, water, and medicament costs. The feed cost regarding about 40-60% from fish production. Hence, there is a need to reduce the cost of feed with increasing the growth performance and high survival rate of fish. Seaweed are a shelter for different generations of marine organisms to promote growth and feed efficiency. Moreover, they act as possible alternative protein sources for farmed fish because of their high protein content and productivity. They have been declared as a "super feed", which has significant positive effects on fish performance due to their nutritive and biological values.

Keywords: Macroalgae; Feeding; Fish

Introduction

Algae are aquatic photosynthetic organisms and the base of food chain. They are the food producing resources that fish are adapted to consume. They can divide into two major groups "microalgae and microalgae (seaweed)" according to their size. Seaweeds are classified into three taxonomic groups: Rhodophyta (red), Chlorophyta (green) and Phaeophyta (brown). They act as a major feed ingredient in nutrional studies and are not considered as an essential fish feed source, but rather as enhancing "standard" feed formulations. Marine macroalgae have been used for healthy feed supplement providing necessary amino acids, beneficial polysaccharides, fatty acids, antioxidants, vitamins and minerals [1,2]. They prefer as food by herbivorous fishes since their stomach have low pH levels and specialize guts required for the digestion of plant materials [3]. Moreover, they improve the immune system, antiviral, antimicrobial, improved gut function and stress resistance serves as an alternative for fish meal, since their proteins do not contain such high P levels, and they would help to take the pressure off wild fish stocks [4]. There is limited evidence that herbivorous and omnivorous fish ".g. trout, salmon, sea basss and seabream" were more effective at digesting and utilizing seaweed in diet.

Recently, there are many researches have been carried out on the use of seaweed as ingredient for aquafeed for different fish species. *Cladophora, Enteromorpha* and *Ulva* species were preferred by *Scartichthys viridis* (Blennidae) and *Sargassum* and *Dictyota* spp. were preferred by *Kyphosus* spp. (Kyphosidae) and *Siganus* spp. (Siganidae) [5]. The green seaweed "*Ulva* and *Enteromorpha*" exhibited a positive effect on growth performance of rabbit fish fry and reduce of the feed cost as half of the feeding rate with artificial feed, but replacement of artificial feed with fresh seaweeds had negative effect on growth performance of rabbit fish fry [6]. The inclusion of 20 -30 % different seaweeds (*Cystoseira barbata*, *Ulva lactuca*, *U. rigida* and *Gracilaria cornea*) in different species of fish meals decreased all growth performance and feed utilization parameters [7]. The incorporation 5% of green seaweed *Ulva lactuca* in *Oreochromis niloticus* feeds promoted growth, diet utilization, immune response, and body composition of *O. niloticus* [8]. The inclusion of 5% red seaweed *Pterocladia capillacea* enhanced some growth performance parameters of European seabass "*Dicentrarchus labrax*" fry, with an increase in body weight, and weight gain [9]. The carcass lipid levels of *O. niloticus*" tended to increase with increasing levels of *Cystoseira* meal [10]. The total cholesterol and triglyceride of *Lates calcarifer* decreased by addition Gracilaria pulvinata this may relate to high algal fiber content and n-3 fatty acids [11].

Macroalgal polysaccharides play vital role in feeding process since they have direct impact on the efficiency of nutrient assimilation in fish gut since polysaccharide can affect digestibility [12]. Alginate extracted from *Ascophyllum nodosum* etimulated lysozyme activity of Salmo salar [13]. Besides the nutritional value, seaweed contain bioactive compounds which exhibited antimicrobial, antiviral, antioxidative, anti-inflammatory, and neuroprotective so improved the immune response and stress resistance and act as scavenger to reactive oxygen species "ROS" [14]. Fucoidan from *Sargassum wightii* increased immunological parameters

such as phagocytic activity, total leucocyte count and respiratory burst activity of *Pangasianodon hypophthalmus* [15].Inclusion of agar from red seaweed enhanced the survival rate of *Aeromonas hydrophila*. Interestingly, seaweed act as the major market for astaxanthin so act as pigmentation source in aquaculture [16]. Astaxanthin, a carotenoid equipped with two asymmetric carbon located at the 3 and 3′ position of the benzenoid rings on either end of the molecule. In 1987, the United States Food and Drug Administration approved the use of astaxanthin as a feed additive for aquaculture and subsequently in 1999 astaxanthin where be approved as a nutraceutical. It was the most important carotenoid in salmons and rainbow trouts [17].

Conclusion

Seaweed or ingredients made of seaweed may be of prime interest for use in fish feed formulations since they are not only profoundly nutritious but also extremely versatile, making them compatible with many foodstuffs already consumed globally. Compared to other aquafeed ingredients, seaweeds are not a supply of nutrients only but also, they are a good source for bioactive compounds that can benefit farmed finfish so they could offer an alternative to the demands of other ingredients used in aquafeed.

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