**DISCUSSION**

**5.1 Effects of natural carotenoid onthe body coloration of blue gourami:**

Skin colouration is an important attribute for ornamental fishes which determines the demand and value in ornamental fish industry (Gouveiaand Rema*.*, 2005). Skin pigmentation, shape of fin and fish size is the major factors determining the commercial value of ornamental fish include, skin pigmentation, shape of fin and fish size (Paripatananont *et al*., 1999). Compared to traditional fish feed ingredients such as fish meal, meat by-product meal, soyabeans and cereals, reliable sources of carotenoids is comparatively costly. Therefore, the current research, which uses natural carotenoids in fish feed, is effective in improving coloration in fish without hindering growth and survival rates. There was also no adverse impact of the feed on the quality of the water. The primary source of pigmentation in ornamental tropical fish is carotenoids, which are responsible for different colours, such as yellow, red and other similar colours. These are typically obtained by species or organisms in the aquatic food chain with a carotenoid material enriched feed. But sources of carotenoids such as zeaxanthin and lutein are used for commercial feed ingredients such as yellow corn, corn gluten meal and alfa-alfa. Marigold meal (lutein), red pepper (*Capsicum sp*.) extract (capsanthin) and krill or crustacean meals are other carotenoid-rich components used (astaxanthin) (Boonyarapatin*et* and Unprasert1989).Several studies have shown improved coloration and significant positive effects of dietary pigments in fish, especially the use of natural pigments from plant sources to improve skin coloration in ornamental fish (Sinha and Asimi, 2007).

In this study, it was selected three natural carotenoid sources for enhance pigmentation, viz., marigold flower , china rose flower and carrot, to evaluate their performance in blue gourami fish, in terms of skin color intensity, whole body carotenoid content, growth. The present study concluded that at the end of the 120-day experimental duration, the average final fish carotenoid absorption was 0.1226mg/100kg±0.0115,0.1296mg/100kg± 0.0169, 0.1669mg/100kg±0.0298 and 0.1487mg/100kg±0.0228 for the T0, T1, T2 and T3 treatments, respectively. Higher results were observed for carotenoid gain in T2 (marigold) (0.1669mg/100kg±0.0298) followed by T3, T1and T0 and lower carotenoid gain in T0 treatment, respectively (control). (Swian *et al.,* 2014) found that marigold oleoresin (180 mg/kg of feed) as a carotenoid source was effective on growth and skin pigmentation of Koi carp as it led to nearly maximum carotenoids accumulation in the body of goldfish. (Liang *et al*., 2012) found that there was a substantially higher deposition of carotenoids in the fish body which was fed a diet supplemented with carotenoids (with 180 mg/kg Marigold oleoresin) diet compared to un-complemented regulation and the other standard of inclusion a dietary carotenoid. The 250 mg of astain is observed to be the highest supplementation per kg of diet was seen deposition of Carotenoids in Koi Carp. The effectiveness of a carotenoid source for pigment deposition varies species to species (Ha *et al*., 1993) and also (Hata and Hata, 1972; Matuno *et al.,* 1981)demonstrated that since marigold meal led to nearly maximum carotenoid accumulation in the skin of goldfish, it should be considered as a valuable source of carotenoids, such as zeaxanthin, lutein or astaxanthin.

**5.2 Effects of natural carotenoid on the growth and survival of blue gourami:**

The development of manufactured feed could be considered as one of the contributing factors to the tremendous growth of this hobby’s widespread popularity over the past 50 years. The acceptability of dependence upon formulated feed for ornamental fish has nutritional requirements as well as their coloration development. In the present study the diet was prepared 30, 27.82, 27.34, and 28.8% of protein. In the present study the proximate composition shows china flower, marigold and carrot’s protein value was 15.7%, 12.3% and 22%. In the present study survival rate of fish was not markedly different within the treatment but growth performance with respect to final mean weight was significantly improved in fish fed with marigold than the other natural carotenoid mixed feed fed. Also the fish fed with china rose supplemented diets showed lowest growth rate. These results are also in agreed with reports that link carotenoids to growth enhancement in Atlantic salmon fry (*Salmo salar*) (Christiansen *et al.,* 1995), rainbow trout (*Oncorhyncus mykiss*) (De la Mora *et al.,* 2006) and goldfish (*Carassius auratus*) (Sinha and Asimi, 2007) Further, observation was made by Ahilan *et al.* (2008) in gold fish fed with coriander incorporation feed at 3 percent level showed better biological performance like weight gain and specific growth rate when compared to other coriander in corporate diet and control. According to Tveranger (1986) and Sommer *et al.* (1992), the addition of carotenoids rich microalgae and krill meal enhanced the growth of trout. In the present study also showed that high protein content in supplemented feed shows high growth at the end of study. For four treatments, the average initial weights were 4.413 g, 4.213 g, 4.31g, and 3.313g for T0, T1, T2 and T3 treatments respectively. After 120 days of experimental period, average final weight of the fishes of four treatments were 5.455±0.821g, 4.504±0.219g, 4.764±0.727 g and 3.776±0.418g in treatments T0, T1, T2 and T3 respectively. Ezhil *et al*. (2008) reported fed with marigold petal 15 g/100 g were increased the growth rate of Red Swordtail (*X. helleri*) reared for 60 days. Sinha and Asimi (2007) Studied the growth rate of fishes in the group fed with the China rose petal feed was the highest in terms of weight, with an increased value of carotenoid in skin (4.01µg/g).Survival of fish is an important aspect in fish culture. Several factors such as accumulation of nitrogenous compounds, feed availability and quality, stocking density etc. affects the survival rate (Randazzo *et al.,* 2017). In the present study, the quality parameters of water were kept within the ideal range and hence didn't supposed to have any major influence on the results. Highest survival rate was found in T2 & T0 treatment (100% survived) and lowest survival rate was found in T1 treatment (75% survived) Inclusion of carotenoid mixed supplementary feed also had no influence on water quality in this study. Moreover, natural carotenoid content which was insoluble in water do not induce/ produce problems due to leaching to the surrounding water medium. This is in accordance with Harpaz and Padowicz (2007) who reported that inclusion of paprika in the diet had no effects on the water quality and survival in dwarf cichlids. However, Arulvasu *et al.* (2013) reported a *Rosa rubiginosa* has negative impact on survival of the fish when it is used for pigmentation.