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Culture Trials and Biochemical analysis of Arabian yellowfin seabream *Acanthopagrus arabicus* Iwatsuki, 2013 to Evaluate Feed Efficacy

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Abstract

Commonly known Arabian yellow fin sea bream (*Acanthopagrus arabicus*) were selected for trials. Specimens were procured from the Sonari channel (24°53'13.81"N 66°41'44.57"E.), shifted to laboratory, and placed into 162 liter capacity glass aquaria, where they were subsequently acclimated for 60 days. Fish were fed in ration of 3% live body weight of feed. Two treatments were placed (T1 & T2). Individuals placed under T1 treated with soybean meal (SM) and individuals under T2 treated with fish meal (FM). Physicochemical parameters were recorded. pH, salinity (ppt), and temperature (27°C) were measured on daily basis, while ammonia, dissolved oxygen (DO), and nitrite nitrogen were evaluated on weekly basis. Length (cm) and weight (g) of under treatment individuals recorded thrice in a month. The mean final weight for treatments (T1 and T2) endured 8.11±0.12 and 8.12±0.13 g, respectively, while the mean achieved length was 10.24±0.11 cm and 10.31±0.12 cm. Results showed the minimal weight increase in T2 alongside the slight difference in specific growth rate. Meanwhile, based on weight increase, feed conversion ratio, and specific growth rate there was a minute difference in growth between the two meals (SM & FM), whereas biochemical analysis revealed that SM impacted the individuals as greater levels of crude fat (51.23±0.947), crude protein (62 ±2.8284) found. Hence, soybean meal (SM), which is affordable, proved that it could be a possible diet that can replace traditional fish meal (FM) for cultivation of *A. arabicus* in aquaculture facilities to achieve marketable size.

Keywords*:* Aquaculture; soybean meal; fish feed; omnivorous

1. Introduction

Fish meal is widely regarded as the premier healthy diet for people worldwide, being the most notable source of various proteins, vitamins, low-saturated fats, and omega-3 fatty acids. Seafood is renowned for its ability to reduce the risk of cardiovascular disease due to the presence of n-3 polyunsaturated fatty acids (Dabrowski *et al.,* 2005; Erkan and Ozden 2007). *Acanthopaprus arabicus* is one of the commercially important species in the group of Pisces. So, due to the commercial significance of *Acanthopaprus arabicus* numerous studies have been made to elucidate different aspect of growth and nutrition of yellowfin seabream species globally. For instance, Saffari *et al* (2021) observed the effects of nano-Selenium add-on in plant protein-rich diet on reproductive performance. Results have shown the higher relative fecundity in females fed at the rate of 4 mg Kg^{-1} N-Se diet ($p < .05$). In the same way, Izadpanah *et al.* (2022) and Mohtashemipour *et al.* (2024) concluded and highlighted the preference of augmenting plant protein based diet with nano-selenium (n.Se)/Kg to enhance the survival and larval length of *A. arabicus* on larval stage. AlKatrani (2023) examined the salinity effect on energy and metabolic enzymes in juveniles and adults of yellow fin sea bream. Study undertaken revealed the reflective enzyme activity in adults. So, there are many studies that have achieved successful results on herbal maturation diets in fish (Al Khawli, 2019).

Molecular and biological makeup of fish meat can facilitate effective food amplification (Njinkoue *et al*., 2016). Nearly 50% of the fish products consumed worldwide in 2016 came from aquaculture, clinched 30.1 million tons of aquatic plants and 80.0 million tons of edible fish. As per past reckoning regarding the production of fish and shellfish for human consumption, 54.1 million tons came from fish, 17.1 million tons from mollusks, 7.9 million tons from crustaceans, and 938,500 tons from other aquatic creatures (FAO, 2018). At 15.3 million tons, China is by far the largest produced globally. Other Asian nations like Indonesia, India, Japan, and Viet Nam are next. With production totals of 2.03 and 0.91 million tons, respectively, Norway and Spain are at the top of the list in Europe (Pateiro *et al.*, 2020).

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Along with nutritional sources of protein and critical amino acids, marine fish larvae can boost the potency of their ability to multiply. In general, larvae transform during the advanced phases, and a variety of significant elements can influence the quality of young and prevent improvement (Naess *et al.,* 1995; Njinkoue *et al.,* 2016). Generally, fish size, species, season, and zone are different quotients between food fish and byproducts (Rustad *et al*., 2011). High quantities of fat-soluble vitamins (A and D), necessary macro and micro minerals, i.e. iodine, magnesium, phosphorus, and selenium, as well as high-quality proteins and balanced essential amino acids are all present in seafood or fish species (Gil and Gil, 2015).

Sea bream is an important fish for the entire world due to its ability to grow in both brackish pond and marine environments (Sadek *et al*., 2004). Iwatsuki (2013) reported that the yellowfin seabream, *Acanthopagrus latus*, which has long been considered a single species in the Indian-Western Pacific, actually comprises five different species, including *Acanthopagrus arabicus* arises in the Middle East towards the western coast of India (excluding the Red Sea).

Ahmad *et al* (2018) assessed growth performance of juvenile *Acanthopagrus arabicus* reared in floating net cages, and juveniles were fed twice daily at the rate of 3%, 5%, 7% and 9% with accordance to their body with a diet containing 42% protein. Results have shown 100% survival rate in all groups up to seven weeks and significant results were found in group three fed with 7% protein to their body weight. Later Ahmad *et al.* (2019 and 2020) investigated the impact of dietary protein level in the practical diet of yellowfin seabream, juveniles to check out optimum growth performance, survival and carcass composition besides feeding frequency influence on growth performance in cage culture was also scrutinized respectively. Previously, Yesser *et al.* (2016) worked on impact of feeding levels on growth performance and food conversion of Acanthopagrus arabicus cultivated in concrete tanks at Basrah province. Recently, Sarvi *et al.* (2023) found out the effect of delayed first feeding on growth and survival of yellowfin seabream (*Acanthopagrus arabicus*) larvae.

There are many studies that have achieved successful results on herbal maturation diets in fish (Dhas *et al*, 2017). Overall, the aquaculture business in Pakistan is developing although at a very modest rate. Despite having a 1001 km long coastline, Pakistan unfortunately ignores mariculture. However, the nation's aquaculture industry has greatly increased GDP (Mohsin *et al.*, 2019). In this context previous study was also carried out to evaluate growth performance, body composition and survival rate of juvenile snakehead (*Channa marulius*) by Kalhoro *et al.,* (2017).

The objectives of the study are to evaluate the growth performance, physiological responses, and biochemical composition of commonly known Arabian yellow fin sea bream (*Acanthopagrus arabicus*) under controlled conditions. Specifically, it seeks to compare the effects of soybean meal (SM) and fish meal (FM) on the growth and health of *A. arabicus*, with the objective of assessing the suitability of soybean meal as a potential alternative to fish meal in the diet of *A. arabicus* for aquaculture purposes. The investigation will include monitoring physicochemical parameters of the water environment, such as pH, salinity, temperature, ammonia levels, dissolved oxygen, and nitrite nitrogen concentrations, to understand their influence on the growth and health of *A. arabicus* under experimental conditions. Key parameters to be investigated include growth performance indicators like weight gain, length gain, and specific growth rate, as well as biochemical composition analysis focusing on crude fat, crude protein, total lipid content, vitamin A and total carbohydrates in the fish specimens. By addressing these objectives, the study aims to contribute valuable insights into optimizing diet composition for the cultivation of *A. arabicus* in aquaculture facilities, potentially enhancing the efficiency and sustainability of sea bream production.

2. Materials and Methods

Acanthopagrus latus which was later re-identified as *Acanthopagrus arabicus* (Iwatsuki, 2013), the experimental fish was identified on the basis of taxonomic features and positioned in glass aquariums according to experimental plan to carry out growth trials based on various feed efficacies. The collection of juveniles of *Acanthopagrus arabicus* was done from the Sonari channel (24°53'13.81"N 66°41'44.57"E) which is located between Sindh and Balochistan provinces near Hub river in October 2019 by using cast net (Figure 1). The experimental fish was identified on the basis of taxonomic features and positioned in glass aquariums according to experimental plan to carry out growth trials based on various feed efficacies. Taxonomic categories of this species are: Phylum Chordata, Class Actinopterygii, Order Perciformes, Family Sparidae (Rafinesque, 1818), Genus Acanthopagrus (Peters, 1855), and the specific identification is *Acanthopagrus arabicus*, Iwatsuki, 2013 (Figure 2). This systematic classification provides a detailed understanding of the organism's biological lineage, facilitating scientific categorization and study within the broader context of marine life (Figure 2). Careful transfer of thriving juveniles from the site to laboratory allowed further experimental research. Taxonomic identification of species was done with the help of Iwatsuki, Y., 2013, FAO (2015), FAO (2018), Froese, and Pauly (Eds.) (2019) and Fish base site. After stocking, all samples were acclimatized for about two weeks within the laboratory conditions, and juveniles were fed on appropriate feed in accordance to research design. Juveniles of fish used in this experiment were fed with two different treatments (T1, T2) and meals: treatment one (T1) received soybean meal (SM), and treatment two (T2) received fish meal FM. Before placing each fish sample into the tanks, its length and weight (g) were measured using a measuring tape or scale and a digital balance, respectively. The samples of fish were then placed in different fish aquariums. Treatments lasted up to eight weeks; there were two replicates used for each treatment. Physicochemical parameters were observed through available devices, i.e. pH (pH meter (EzDO 6011, Taiwan), temperature (digital thermometer), salinity (refractometer), dissolved oxygen (portable test kit (Merck KGaA, 64271, Germany), ammonia test kits (Merck KGaA, 64271, Germany) and nitrite nitrogen test kit (Merck KGaA, 64271, Germany) were used to lookup the water quality for the improved development of juveniles.

Analysis of both treatments was done with the help of statistical analysis (statistical Minitab software (17.0 version) in which one-way analysis of variance (ANOVA) was carried out. The length weight data is presented by means of total mean and standard deviation. Biochemical analysis was performed for following juveniles after culturing of specific juveniles for the provided feeds. Growth indices such as weight gain, mean daily weight gain, percent weight gain, Feed Conversion Ratio, Condition factor (CF), Specific growth rate (SGR) and survival rate (SR) **w**ere calculated from the data collected in present research by the help of literature of earlier authors. The nutritional composition of our formulated diets is as listed below and shown in Figure 3.

Figure 1. Collection site: Sonari channel 24°53'13.81"N 66°41'44.57"E (Google Maps 2023).

Figure 2. The overall appearance of *Acanthopagrus arabicus* Iwatsuki, 2013.

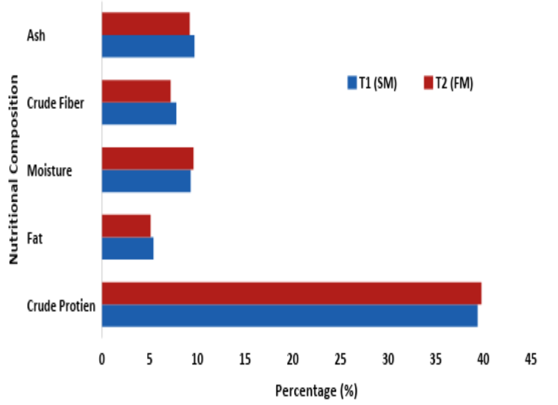

Figure 3. Biochemical analysis of experimental diet.

3. Preparation of samples

Complete proximate analysis of juveniles for two different treatments provided were done such as total lipids, crude protein, vitamin A, organic and inorganic content with the help of classical methods. The samples of *Acanthopagrus arabicus* were prepared for biochemical analysis. First of all, samples from both treatments tanks were sacrificed collected and then they were dissected and then dried at 80- 105 ^{O}C for 24-26 hours. After crushing the samples, placed them in glass vials for further biochemical analysis. The extraction of crude fat was done by following the method as described by Triebold and Aurand (1963) by the help of soxhlet extraction method. The determination of crude protein from the dried sample was done by the micro-kjeldahl distillation method (Hawk *el al*., 1954). The total inorganic content was determined by using the standard method of AOAC (2000). The organic content was determined by the help of official methods of analysis, The Association of Official Analytical Chemists **(**AOAC) standard method (2000). Calcium content was determined by the method of titration with the help of AGQ laboratory. Vitamin A was determined by the SPE (Solid Phase Extraction) method by the Reverse phase HPLC with the help of AGQ laboratory. It was determined by the classical method of phenol sulphuric method in the lab of Institute of Marine Science, University of Karachi.

4. Results

4.1. Growth Indices and Physicochemical parameters

The summary of growth parameters of sea bream (*Acanthopagrus arabicus*) for the duration of experimental trial and water quality parameters were enlisted in Table 1 which are the basic requirements for maintaining the aquaculture set up and maintaining the growth of fish species. In T1, average weight and length were measured 8.11±0.12 gm and 6.65±0.05 cm respectively, and in T2 average weight and length were 8.12±0.13 gm and 6.71±0.04 cm respectively. However, there is no noteworthy difference in the initial length and whole body weight of specimen treatments. Nevertheless, in the end, fish growth was assessed and calculated as difference of mean initial weight and length in both treatments. The average attained final weight ranged in between 22.78±0.4 gm (T1) to 23.15±0.3gm (T2), whereas mean length was

10.24±0.11 cm to 10.31±0.12cm among all treatments respectively. The slightly higher or negligible weight gain was experiential in T2 rather than T1. There is no noteworthy differentiation in specific growth rate, but for T2 it is slightly higher than the T1. The feed conversion ratio of juveniles for soybean meal was slightly greater than as compared to the fish meal but it is non-significant. 100 % Survival rate was observed. (Table 1). Length (cm) and weight (g) relationship showed that fish persisted healthy and in good physical shape during the entire investigational period as values of slopes in all treatments were significant (Figure 4 A-B).

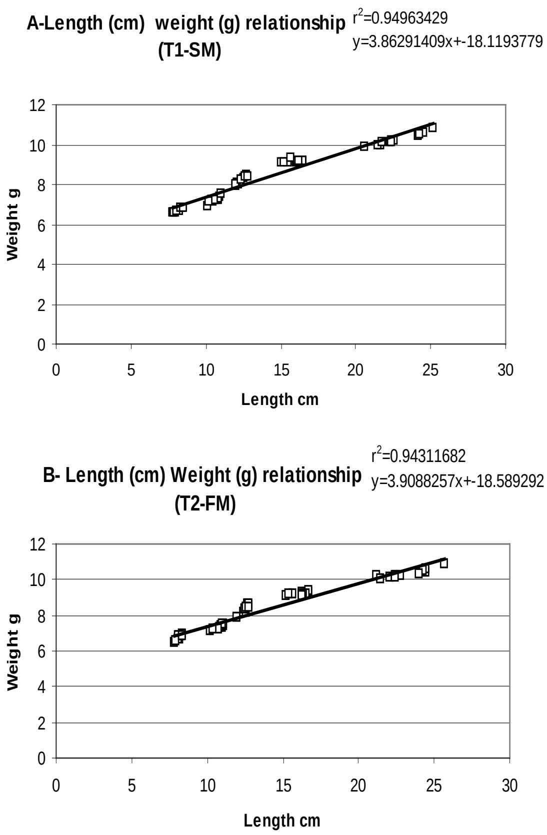

Figure 4.(A-B) Correlation between weight (g) and length (cm) (pooled data) of experimental fish treated with different diet/ treatment. [Treatment 1 (T1) & 2 (T2): FM-fish meal; SM-soybean meal

During the experimental protocol, average temperature was 27.747±1.197^{o}C in T1 and in T2 average temperature was 27.468 ± 1.277 ^{o}C, average salinity was about 30.263 ± 0.452‰ in T1 and 30.105±0.459‰ in T2 , pH of water ranged between 7.4 to 7.5 with average of 7.4784 ± 0.2274 throughout the experimental period in T1 and 7.4926 ± 0.1980 in T2, average levels of dissolved oxygen were measured 7.335±0.021 during the experimental period in T1 and in T2 it was observed with the average of 7.35 ± 0.021, Nitrite nitrogen concentration was observed in T1 and T2 with average of 0.019±0.0007 mg/l and 0.015±0.0007 mg/l correspondingly, The ammonia concentration estimated between 0.01 to 0.05 with average of 0.0465±0.0064 and 0.01±0.0007 mg/l in T1 and T2.

Table 1 (a) Growth indices of sea bream (*Acanthopagrus arabicus*) for both treatments over 60 days (FM-fish meal; SM-soybean meal) and **(b)**Summary of physicochemical parameters for both treatments over 60 days (FM-fish meal; SM-soybean meal).

Parameters	Treatment 01 (SM)	Treatment 02 (FM)
For Growth indices		
Initial Length (cm)	6.65±0.05	6.71±0.04
Final length (cm)	10.24±0.11^{b}	10.31±0.12^{a}
Initial weight (g)	8.11±0.12	8.12±0.13
Final weight (g)	22.78±0.4^{b}	23.15±0.3^{a}
Weight gain	14.67±0.2^{b}	15.03±0.5^{a}
Specific growth rate	1.72±0.03^{b}	1.75±0.02^{a}
Feed conversion ratio	1.69±0.01^{a}	1.67±0.02^{b}
Condition factor	2.12±0.03^{a}	2.11±0.04^{b}
Survival rate	100±0.0	100±0.0
WG% IW	14.6±1.67^{b}	15.03±1.7^{a}
Physicochemical parameters		
Water Temperature (^{0}C)	27.747±1.197	27.468±1.277
Salinity(‰)	30.263 ± 0.452	30.105±0.459
pH	7.4784 ± 0.2274	7.4926±0.1980
Dissolved Oxygen (mg/l)	7.335±0.021	7.35±0.021
Nitrite Nitrogen (mg/l)	0.019±0.0007	0.015±0.0007
Ammonia (mg/l)	0.0465±0.0064	0.01±0.0007

ANOVA (P<0.05) Duncan new multiple test range (Mean±SE). Different superscripts showed significant differences among groups.

4.2. Biochemical Analysis

In the current research, we have performed certain biochemical tests to evaluate the rate of growth, activity and development of the cultured species. Following are the tests which were performed after the experimental period for comparing the quality of meat according to their feed utilization and the results were being analyzed by different experimental protocol which are listed below and summary of all outcomes are presented in Table 2.The concentration of total lipid was found higher in T2 (which was fed with fish meal) than that of T1.The results showed the average values in percentage of total lipid content is 0.8±0.1414 gm in T1 and 1.45±0.4949 gm in 22 (Figure 5), the concentration of crude fat in T1 was 51.23±0.947 % and in T2 was 28.53±0.671 % which is shown in Figure 6, the resultant values of crude protein were 62±2.8284 % for T1 in which juveniles were fed with soybean meal and 33.5±2.121 % in T2 (Figure 7), The ash content was found about 0.936 ±1.50 % in first treatment and it was found 0.676±1.06 % in the other treatment (Figure 8), The moisture content was found about 0.426±0.133 % in first treatment and in the other treatment it was found 0.518±0.064 % (Figure 9), In T1 the calculated value of calcium content was 19.94±0.091 % whereas in T2 it was found approximately 20.25±0.35 % (Figure 10), The calculated values of vitamin A was 9±1.414 % and 10±1.414 % in T1 and T2 respectively(Figure 11), total carbohydrates content was 12.75±0.4949 % and 15±0.707 % in T1 and T2 respectively (Figure 12).

Table 2. Summary of proximate analysis of the fish meat according to the different diets which were fed in the whole experimental period.

Proximate Analysis	Treatment 1	Treatment 2
Total lipid content (%)	0.8 ± 0.1414	1.45±0.4949
Crude Fat (%)	51.23±0.947	28.53±0.671
Crude protein (%)	62 ±2.8284	33.5±2.121
Ash content (%)	0.936±1.50	0.676±1.06
Moisture Content (%)	0.426±0.133	0.5185±0.064
Calcium content (%)	19.94±0.091	20.25±0.35
Vitamin A (%)	9±1.414	10±1.414
Total carbohydrates (%)	12.75±0.4949	15±0.707

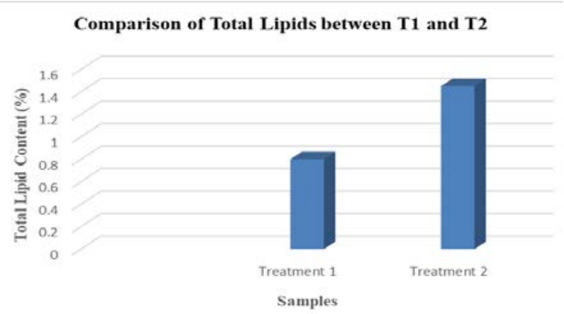

Figure 5. Comparison of total lipids in fish body between two different diets

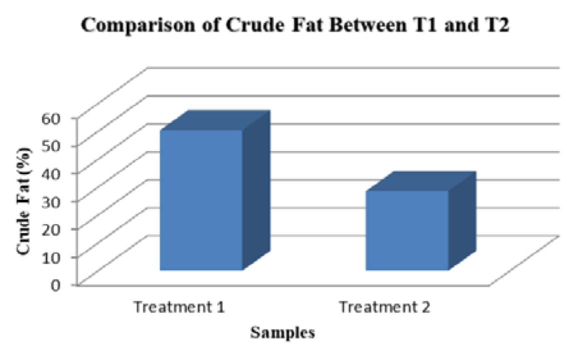

Figure 6. Comparison of crude fat in fish body between two different diets

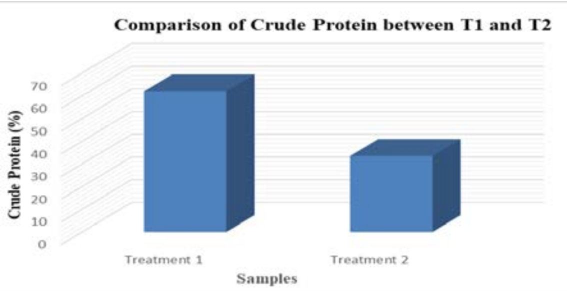

Figure 7. Comparison of crude protein in fish body between two different diets

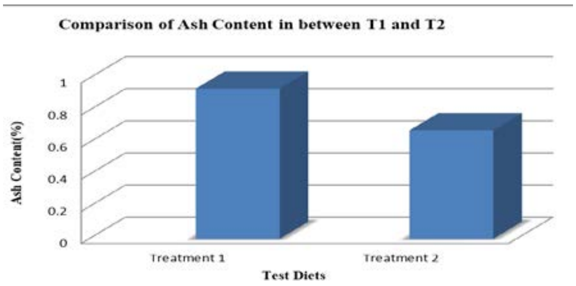

Figure 8. Comparison of ash content in fish body between two different diets

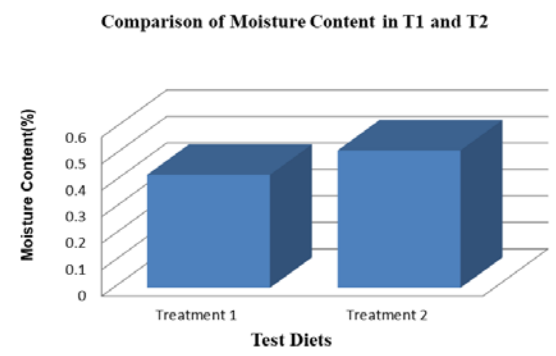

Figure 9. Comparison of Moisture content in the body of fish between two different diets

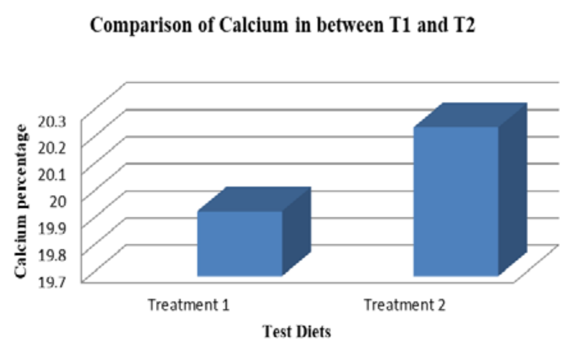

Figure 10. Comparison of calcium content in the body of fish between two different diets

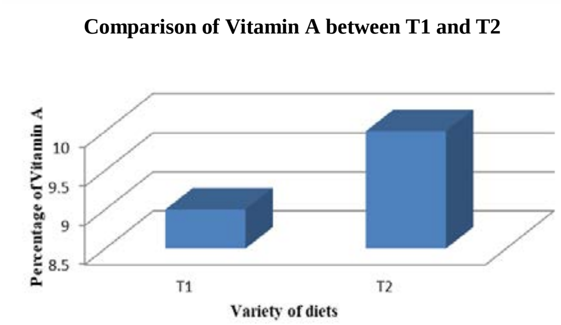

Figure 11. Comparison of Vitamin A content in the body of fish between two different diets

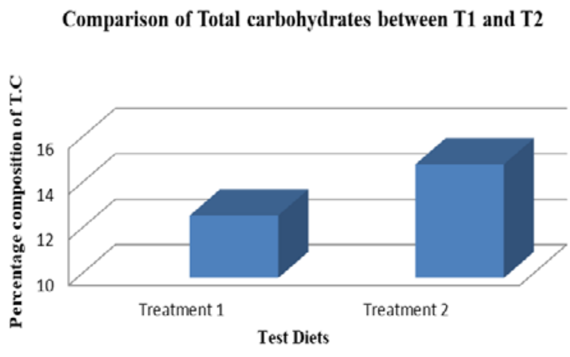

Figure 12. Comparison of Total carbohydrates content in the body of fish between two different diets

5. Discussion

In this current research, juveniles of yellow fin sea bream *Acanthopagrus arabicus* were utilized and they fed on two different compositional diets for eight weeks with different nutritional qualities under controlled conditions with weekly assessment of water quality parameters along with length and weight relationship. According to the results, the weight gain of the juveniles nourished using fish meal diet was a little higher than the juveniles fed with soybean meal but there was no significant difference so it is suggested that fish meal can be substituted by the cheaper soybean meal because it can be the appropriate diet for juveniles of *Acanthopagrus arabicus* that can give us an idea about better growth similarly like the fish meal. According to the Gallagher (1994), it was observed that the swapping of the soybean meal with the fish meal has been performed in the hybrid striped sea bass fish with different protein concentrations for 12 weeks trial and found that the gained weight of fish as compared to the initial weight in both the treatments was not significantly different and this trial was performed on variety of juveniles having different body weight and size then concluded that there were no noteworthy difference has been found for changing the diet so it was suggested that fish meal can be replaced by vegetable meal (Gallagher,1994). In 2019, Huaqun *et al.* conducted an eight-week trial focusing on the replacement of fish meal with soybean meal in the juveniles of the obscure puffer (*Takifugu obscurus*). During this trial, they meticulously observed various growth parameters. As a result, they came to the same conclusions: there was no significant difference in weight gain, and the juvenile fish showed a specific growth rate (Huaqun *et al.,* 2019). Kissil *et al.* (2000) claims that they carried out a 56-day experiment in which they investigated biochemical parameters by substituting soybean and rapeseed meal for fish meal. Following the trial, the concentration of protein and ash showed no discernible variances; however, the lipid and energy levels varied. In summary, they found that young sea bream can successfully get protein from both soybean and rapeseed (Kissil *et al.,* 2000). De Francesco *et al.* claim that they conducted an experimental trial on the eating behavior of gilthead sea bream in 2007 and switched the FM diet intended for a diet high in plant protein. It was determined that whereas feed efficacy and protein efficacy ratio were better in the sea bream PP diet, the intake of feed was higher in the sea bream FM diet. In contrast to PP, meals containing Fish Meal (FM) exhibited higher levels of moisture content but lower amounts of PUFA (polyunsaturated fatty acids) and MUFA (monounsaturated fatty acids) (De Francesco *et al.*, 2007).

Ajani *et al.* (2016) conducted a trial in which fish meal was relieved with four altered types of soybean meal: partial soybean meal, no soybean meal, only soybean meal, and soybean with methionine; the results revealed the average gain in weight, that was 22.77 grams and length was 16.90 grams which is notably raised in partial soybean meal (PSM) and a smallest amount found in no soybean meal (NSM) that was 17.54 grams and 14.63 cm (Ajani *et al.,* 2016). According to the previous studies, the outcomes showed that the specific growth rate and feed conversion ratios were slightly higher in diet 2 than the diet 1, while the conversion of feed was slightly greater in diet 1.

In 12-weeks trial on gilthead sea bream, fish oil and fish meal were substituted by different plant proteins, and the findings revealed that there was no statistically significant difference in weight gain between the two diets when 40 or 60 percent of the fish meal was interchanged by the plant proteins, but there was a slight loss of weight when 65 percent of the FM and 65 percent of the FO were substituted (Dias *et al.,* 2009). According to Wang *et al.* (2006), they studied *Nibea miichthioides* growth after replacing fish meal with soybeans, and they came to the conclusion that as the concentration of fish meal in the diet decreased, so did weight decreases, and it was noted that replacing 20% of the fish meal with soybeans had no discernible special effects, while replacing 100% of the fish meal had weight loss (Wang *et al.*, 2006). The results of the 12 week experimental study showed no discernible differences in weight increases; nevertheless, the rate of specific growth was higher in the control diet, which contains animal meal, than in the other diets, which used soybean meal as a substitute at rates of 12 and 36 percent. The FCR was also lower than with the other interventions (Karalazos *et al.,* 2007). After 125-day trial substituting soybean meal for fish meal in the diets of rainbow trout (*Oncorhynchus mykiss*), it was found that there were no significant differences in weight, specific growth rate, or feed conversion ratio. As a result, it was recommended that soybean meal can be substituted for 80 percent fish meal in rainbow trout adults (Voorhees, 2019). According to the results of the contemporary study, it was found that we can either completely replace fish meal (FM) with soybean meal (SM) because there is no noteworthy change in the growth and survivability of fish juveniles thus the meal having the vegetable origin would be the good replacement for the aqua culturist.

Moreover, fish species' growth indices would be adequate, and their survival rates would be 100%. In our research trial, we have adjusted the physicochemical parameters at optimum level as mentioned in our results to avoid any discrepancy. Jian and Cheng (2003) worked on the salinity and temperature tolerance of *A. latus* in which they concluded that the highest tolerated salinity could be 50‰ when they gradually increased the salinity levels (Jian and Cheng, 2003). Iqbal *et al.* (2012), worked on *Oreochromis niloticus* to reveal the impact of salt concentration on the progression of fish and the outcomes revealed the mean WG (weight gain) and mean LG (length gain) greater at higher levels of salinity and in contrast reduced growth was observed in control group. Moreover, feed conversion ratio (FCR) was also found increasing with the raised levels of salinity thus better growth was observed in increasing salinity levels (Iqbal *et al*., 2012). Endurance and growth in juveniles of fish were not being affected at various salinity levels until temperature would be greater than 27 ^{0}C, but it can produce prominent effects when the temperature would be beneath 25 ^{0}C (Watanabe *et al*., 1989). The species of sea bream are susceptible to oxidative stress, and it was determined that the fatal concentration of dissolved oxygen was approximately 0.1 milligrams per litre; for this reason, *Sparidentex hasta* is classified as an oxy-conformer (Zainal, 2016). In the current thesis, DO was adjusted at 7 to 8 mg/l, which is thought to be a satisfactory range for the species of sea bream to grow more successfully. Rahim *et al.* (2017) studied the growth factors of juveniles of black fin sea bream in brackish water ponds where fish were fed a variety of artificial diets and the physicochemical properties of the ponds modified such as salinity ranged between 15 and 20 parts per thousand, range of temperature stayed between 25 °C to 28 °C, pH ranged from 7.6 to 7.8, both ponds remained slightly alkaline; nitrite, nitrogen and ammonia concentrations was less than 0.001 mg/l. DO ranged from 5.6 to 7.5 mg/l. In their 2015 study, Rahim *et al.* conducted a controlled cultivated experiment, maintaining optimal values for water quality parameters. Specifically, dissolved oxygen (DO) was held at 6.5±0.4 mg/l, pH around 7.3±0.2, temperature at 26±0.3°C, ammonia and nitrites registering less than 0.01 mg/l, and salinity maintained between 15 and 16 parts per thousand (Rahim *et al*. 2015). Tseng and Hsu (1984) conducted an experiment in which they cultured marine copepods and *Acanthopagrus latus*, as well as these copepods used as a diet for the juveniles of *A. latus* that housed in aquaria with optimum aeration in sea water, with specific gravity of 1.015, temperature ranging from 25 to 28 ^{0}C, and salinity of 24 ppt (Tseng and Hsu, 1984). The study of proximate composition for the total body meat of juvenile fish was carried out in the current research experiment, and the findings for diets 1 and 2, which contain soybean meal and fish meal respectively, were discovered. Yang *et al.* (2015) conducted an experimental trial in which they observed the effects of substituting fish meal with soybeans on the growth of juveniles of *Litopenaeus vannamei*. Their main finding was that the amount of crude protein in the juveniles' bodies was higher in the diets containing 4.28% ESBM than the diets containing 25.26% ESBM, while the concentration of crude lipid of the juveniles' bodies was higher in the diets containing 11% ESBM (Yang *et al*., 2015). Thus the dietary interventions very minimally changed the contents of fatty acids (Karalazos *et al.,* 2007). Rahim *et al.* (2017) contributed a preliminary study on growth factors using juvenile black fin sea bream as the target species in brackish water ponds. Fish were fed a variety of artificial diets, and the proximate composition of the treated groups was analogous to the control groups in terms of moisture and ash concentration. However, the lipid and protein concentration of the treated clusters was greater than that of the control groups, and it was determined that feeding diets with a combined 42 percent protein content and 20 percent lipid content is optimum for cultivating black fin sea bream. Also, it was determined that there was no discernible difference between the treated and control groups' body compositions (Rahim *et al.,* 2017). The Gilthead sea bream (*Sparus aurata*) was used in an experiment to define the effects of mannan oligosaccharides on two different intakes made of fish meal and soybeans, which have different nutrient compositions. The findings showed that neither diet significantly changed the nutrient composition of the body nor the final WG, PER, SGR, or FCR (Dimitroglou *et al.,* 2010). Rahim *et al.* (2016) conducted an experiment on young *A. berda* fish in which artificial diets with varying protein composition were fed to the fish. The results showed increased weight gain and growth intensity at 40% and 50% protein ratios, and the biochemical analysis of the whole fish showed that the moisture content was higher in the fish fed diets of 40% to 50% than the 20 to 40% protein diet, while the lipid content at 40% to 50% was observed (Rahim *et al*., 2016). Rahim *et al.* (2015) studied different lipid concentrations and observed changes in growth indices in *A. berda*. They fed 42 percent protein diet with various lipid concentrations as 15%, 20%, 25%, and 30%. It was found that the 20 percent lipid-containing diet revealed the highest WG, SGR, and lowest FCR, and that the product quality of meat, particularly ash content, protein, and lipid profile, was unaffected by any lipid variations in diet (Rahim *et al.,* 2015).

Alasalvar *et al.* (2002) studied the *Dicentrarchus labrax* commonly named as sea bass and determined that there were substantial changes between wild and cultivated sea bass based on the amount of fatty acids and minerals in the flesh of fish (Alasalvar *et al*., 2002). Similar work has been done by another researcher who assessed the differences between the wild and farmed gilthead sea bream. In this study, the analytical units were flesh attributes, and the main factors were morphological traits, fat content, and fatty acid profile. Higher lipid content and lower GSI levels were detected in cultured fish than in wild fish, respectively. Moreover, morphological traits were varied between fish from the wild and those raised in captivity (Grigorakis et al., 2002). Similar research was done by Orban *et al.* (2003) using two other species of fish, *Sparus aurata* and *Dicentrarchus labrax*, to assess the variations in lipid content between farmed and wild fish. They discovered that each of the cultured species had higher levels of lipid content than the wild species (Orban *et al.*, 2003). The juveniles of *Acanthopagrus arabicus* were the target species in Ahmad *et al.* (2018) study; the work has been done on the relationship between feeding frequency proportions and defensive capabilities, body nutritional composition, and growth rate. The results showed that growth rates were best at 7 percent body weight/day, with the smallest growth rates being 5 percent, 9 percent, and 1 percent weight gain after treatments. Protein and ash levels did not alter much; however, fat content did increase with increasing feeding frequency (Ahmad *et al.* (2018). Peres and Oliva-Teles (1999) studied the effects of feed modifications in terms of the developmental growth of juvenile European sea bass. They fed the juveniles feed containing 48 percent protein with higher lipid intensity levels of 12, 18, and 30 percent. In contrast to other diets with larger amounts of lipid, it was found that low lipid diets had higher quantities of protein, and their lipid and calorie contents were also reduced. The results showed that raising the nutritive lipid percentage from 12 to 24% does not impact growth developmental rates, feed competence, or protein. Liver lipid concentration was greater in diets with the highest levels of lipids, but it had no impact on the lipid content of the muscles. Yet, a diet with 30 percent lipids can reduce protein and calorie content while having no negative effects on development (Peres and Oliva-Teles, 1999). Fish oil is one of the best sources of efficiency, intensity, and strength, followed by soybean oil, according to Rahim *et al*. (2017), who conducted a preliminary research trial on the juveniles of *A. berda* and fed them on four different feeds with oil: fish oil, soybean oil, palm oil, and olive oil (Rahim *et al*., 2017).

6. Conclusion

The current research was intended to carry out some fundamental investigations on the effectiveness of feed on *Acanthopagrus arabicus* in light of market requirements and the importance of produced fish's nutritional quality. The work that was scheduled was intended to provide knowledge and information on the evaluation of macromolecules using a variety of biochemical analyses and chemical tests to correlate with the obvious characteristics necessary for a particular fish species' culture to advance robustly. Therefore, in the light of our results it is concluded that fish meal can be substituted by the soybean meal because it can be the appropriate diet for juveniles of *Acanthopagrus arabicus.* Research undertaken gives an idea for cheap ad cost-effective soybean meal that can replace effortlessly other high cost fish meal to achieve good market oriented results.

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