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Research Article

Investigating The Chemical, Sensory, and Microbial Properties of Pasta Enriched with Silver Carp Protein Concentrate (Hypophthamichthys Molitrix)

Soghra Kamali[1], Mehrdad Nasri Tajan[2]* and Mina Seifzadeh[1]

[1]*National Fish Processing Research Center, Inland Waters Aquaculture Research Center, Iranian Fisheries Science Research Institute, Agricultural Research Education and Extension Organization (AREEO), Bandar Anzali, Iran*

[*2]*Department of Fisheries, Bandar Anzali Branch, Islamic Azad University, Bandar Anzali, Iran*

***Corresponding author:** Mehrdad Nasri Tajan, Department of Fisheries, Bandar Anzali Branch, Islamic Azad University, Bandar Anzali, Iran

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Abstract

Obtaining fish protein concentrate from minced Silver carp involved a three-step process utilizing solvent (Isopropanol), drying, and pressing at a dry temperature of 60°C. The resulting concentrate boasting 93% protein content, is recognized for its nutritional richness in aquatic protein sources, commonly employed for enhancing various food products. Addressing the deficiency of lysine and threonine in current macaroni production this study explores opportunities to argument and refine its nutritional quality. Pasta enrichment was performed using ratios of 0%(control), 5% and 15% fish protein concentrate. Samples, prepared in triplicate, were stored at ambient temperature for three months and subjected to tests covering nutritional value, coriander, microbial content, sensory properties, and amino acids. Comparative analysis was conducted with the control sample lacking concentrate. Experimental results, encompassing food, chemical, sensory, microbial, and amino acid profiles, were determined through statistical tests. while protein percentage enrichment treatments exhibited superior nutritional value including protein percentage Fat, and amino acid profiles taste considerations and the extended shelf-life of the 5% concentration were noteworthy. The overall assessment favored the sample enriched with 5% fish protein concentrate demonstrating a significant difference ($P<0.05$).

Keywords: Fish protein concentrate; cultured silver carp; enriched pasta; shelf life

Introduction

Fish is renowned for its high nutritional value, ranking highest in protein content and serving as a rich source of vitamins (B, A, D), essential amino acids, a various minerals, including magnesium, phosphorus, iron, and even iodine [1]. With the increasing global demand for protein, and limited resources to meet the needs, Authorities emphasize the importance of using marine resources extensively. The individual's annual protein product requirement, based on age and weight, averages around 15.5 kg. All in all, millions of tons of pure protein will be needed by the community. Aquaculture plays a pivotal role as a nutritious food source than valuable animal protein has been proven, providing approximately 20% of the animal protein in modern societies. They have a very good position and compete with other protein sources [2]. Developing countries have made significant strides in addressing protein poverty and enhancing per capita aquatic resource consumption through water resource exploitation, aquaculture expansion, as well as studying,

researching and investing in the processing of aquatic species. As of today, more than 150 types of products from various types of fish such as sausages, surimi, and salami... have been produced.

Consumption of cereal products is very common among today's societies due to its high taste and taste. Various types of pasta ingredients, the shape and the things that can be used to make it a popular product among people. In the macaroni industry, many of the additives used for enrichment have been misused due to lack of sufficient information to put human health at risk. Therefore, it is necessary to make the necessary studies to make sure that the ingredients are used too. Due to the differing consumer tastes and different baking practices, as well as the high demand for this product, food has been increasing in the world. So, with regard to the prevalence of ill-caused ill-health, we are now pushing for the production of products that guarantee the health of consumers [3]. Noodles, a vital cereal product, plays a crucial role in modern societies' due to their simplicity, high baking quality and extended shelf life. So, the need for research to improve the quality of cereal products is increasing. Despite their carbohydrate-rich composition (11-15% protein), noodles lack lysine and threonine amino acids. Fish protein concentrate, rich in essential amino acids, presents a viable solution.

Usually in advanced countries, dried, salted and fermented fish products. [4]. Among the products used for macaroni enrichment, fish protein is notable. Protein powder concentrate is grayish milky which has a high nutritional value and is produced in most countries under strictly hygienic conditions for edible fish. FPC has a very high nutritional value used in many countries for human consumption. We can use any type of fish to produce protein concentrate. The quality of raw material for producing FPC affects its quality accordingly, if corrosive substances are used, the amount of histamine, trim ethylamine and dimethyl amine in the final product will increase [5].

Materials And Methods

To produce fish protein concentrate is a combination of physical and chemical processes. At first, silver carp with a mean weight of 800-900 grams, approximately 11 kg and 12 pieces in spring were prepared live fishponds in Guilan province. After catching silver carp, ice-cold kept in a refrigerator car to the location of the National Research Center for Aquaculture and after weighing until the start of operation at a low temperature (40 C). After deheading, the fish's viscous is drained. Filled fish are washed with clean water, livers, and blood and fish saltines by brushing. The digestive system of fish, kidneys and liver contains protolithic enzymes. Therefore, if these organs are not eliminated, the quality of the fish undergoes undesirable changes. After complete washing, the fillets are placed inside the bone stack. The base of this machine is based on a rotating grille, a fish fillet is pressed between it and a thick rubber belt, a grille; meat is removed from the skin and bone. The perforations of the cylindrical lattice are 4-8 mm in diameter.

Then, the pure meat weighing 5.5 kg was placed in isopropanol (two parts of alcohol and one part of meat) for 50 minutes at ambient temperature (25.80 C) for 50 minutes, after the time. The first press was carried out, where the initial press cake was transferred to the second phase of the production of concentrate. In the second stage of extraction, the press cake prepared from the previous step was placed in 2: 1 in isopropanol and placed in Ben Mary for 90 minutes at a temperature of 750 C. After the time elapsed, the product was pressed and immediately after weighing, the dryer was transferred to a temperature of 1250 C for 3 hours, the product was manufactured by the mill and passed through a 100 micron screen Ref?

The Method of Supplement Enriched Pasta with FPC

The main raw materials used for the preparation of fish protein concentrate-enriched pasta in three treatments, 0%, 5% and 15% are Fish Protein Concentrate (FPC), Semolina Flour, Dry Gluten and Water for a Period at least 3 minutes into the Pilot Plant, the Italian compound was mixed, then the water was added to the formulation for 20% of the weight of the flour and continued to be used for 10 minutes to form the gluten network, Finally, the mixture was extracted under a temperature of 450 C with picolar bronze and pressed 0.6 mm Hg. During the outlet process, the temperature of the dough was removed from the mold under a temperature of 200 C, so that the macaroni from the mold did not stick together and did not lose its shape. macaroni extracted from the mold was first poured onto plastic trays and the fan under the tray was constantly on to prevent the sticking of pasta during the process. The macaroni is then placed on a wooden tray with a plastic net to transfer to the dryer, and the dryer automatically dry. The macaroni drying process was carried out in two steps, the initial drying step was carried out at a low temperature (about 500C) and a high humidity (55%) for 2 hours, to avoid the rapid drying of the surface and In the second stage, drying is used at high temperatures (750C) and low humidity (20 to 30%). At the end of the drying process, 10% moisture content was obtained, which was then spent for 3 hours. Dried pasta was stored after cooling in a normal packing and under ambient temperature (250C).

Results

For the purpose of this research, freshly caught fresh-fished meat was used in FPC production and compared with 5 and 15% FPC ratios for enriching pasta with control sample (T1). Qualitative evaluation of the final product (chemical, microbial, acid profiles Amino and sensory) are maintained at ambient temperature and the results are as follows (Table 1&2):

Non-homonymous letters in each row indicate a significant difference at the 5% level ($p<0.05$). The average of approximate compounds of amino acid profiles in treatment 3 with 15% enrichment for 6 amino acids aspartic, glutamic, arginine, serine, histamine, and glycine were higher than other treatments and 5% treatment was carried out at the next stage and the results of the data are significant. non-homonymous letters in each row indicate a significant difference at the 5% level ($P <0.05$) (Table 3). The average of approximate compounds of amino acid profiles in treatment 3 with 15% enrichment for 6 amino acids of trio nine, alanine, tyrosine, cysteine, valine and mitoinin are higher than other treatments and 5% treatment is in the next stage and the results

of the data Are significant non-homonymous letters in each row indicate a significant difference at the 5% level (P <0.05) (Table 4). The average of the approximate compounds of amino acid profiles in treatment 3 with 15% enrichment for 6 amino acids tryptophan, phenylalanine, isulosin, Lucien, lysine and proline is higher than other treatments and 5% treatment is in the next stage and the results Data are significant. Non-homonymous letters in each row indicate a significant difference at the 5% level (P <0.05) (Table 5).

Table 1: Measurement of the percentage of approximate compounds in the control treatment and compare it with two treatments enriched with fish protein concentrate after three months of storage at ambient temperature.

Factors	Treatment 1 (control)	Treatment 2 (5% enriched)	Treatment 3 (15% enriched)
Protein	11.4±0.5^{a}	15.5±0.6^{a}	52.2±1.2^{a}
Fat	3.2±0/11^{b}	3.6±0.12^{b}	4±0.11^{b}
Moister	7±0.14^{b}	7.2±0.13^{b}	7.35±0.14^{b}
Ash	1.18±0.007^{c}	1.18±0.008^{c}	1.29±0.008^{c}

Table 2: Measurement of the percentage of amino acid acid profiles in the control treatment and comparison with two treatments enriched with fish protein concentrate after three months of storage at ambient temperature.

Treatments	Aspartic	Glutamic	Arginine	Serine	Histidine	Glycine
Treatment 1 (control)	0.12±0.04^{b}	2.63±0.04^{c}	0.11±0.09^{c}	0.81±0.06^{b}	0.41±0.3^{c}	0.6±0.04^{c}
Treatment 2 (5%)	1.36±0.03^{a}	3.33±0.03^{b}	0.92±0.01^{b}	4.55±64.27^{a}	1.3±0.1^{b}	1.02±0.26^{b}
Treatment 3 (15%)	1.46±0.07^{a}	5.75±0.06^{a}	3.41±0.4^{a}	4.55±0.4^{a}	155±0.2^{a}	0.44±0.73^{a}

Table 3: Measurement of the percentage of amino acid profiles in the control treatment and compare it with two fish protein concentrate enriched treatments after three months of storage at ambient temperature.

Treatments	Threonine	Alanine	Tyrosine	Cysteine	Valine	Methionine
Treatment 1 (control)	0.55±0.042^{c}	0.60±0.2^{c}	0.46±0.18^{c}	0.35±0.04^{c}	0.77±0.28^{c}	0.275±0.007^{c}
Treatment 2 (5%)	1.32±0.19^{b}	1.54±0.03^{b}	2.18±0.11^{b}	2.41±0.43^{b}	2.35±0.35^{b}	3.008±0.002^{b}
Treatment 3 (15%)	5.65±0.38^{a}	6.13±0.04^{a}	7.43±0.079^{a}	8.50±0.06^{a}	8.88±0.07^{a}	9.25±0.05^{a}

Table 4: Measurement of the percentage of amino acid profiles in the control treatment and compare it with two fish protein concentrate enriched treatments after three months of storage at ambient temperature.

Treatments	Tryptophan	Phenylalanine	Isoleucine	Lucien	Lysine	Pralines
Treatment 1 (control)	0.21±0.08^{c}	0.93±0.2^{c}	0.71±0.2^{c}	1.41±0.41^{c}	0.67±0.43^{c}	1.63±0.24^{c}
Treatment 2 (5%)	3.12±0.03^{b}	2.5±0.5^{b}	3.07±0.08^{b}	2.8±0.19^{b}	3.28±0.12^{b}	4.01±0.07^{b}
Treatment 3 (15%)	9.67±0.07^{a}	10.1±0.07^{a}	10.3±0.07^{a}	10.62±0.05^{a}	11.06±0.04^{a}	13.67±0.02^{a}

Table 5: Relationship between Taste assessment and Organoleptic score at 4phases time Pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	4.57±0.53^{a}	5±0.14^{a}	4.42±0.53^{a}
After a month	5±0.14^{a}	4.85±0.37^{b}	3.71±0.48^{b}
After two months	4.57±0.53^{a}	3.85±0.37^{b}	3.57±0.53^{c}
After three months	4.14±0.37^{a}	5.28±0.48^{b}	4.28±0.95^{a}

In terms of taste assessment, 5% and then 15% and control treatments are in the next stages, and these values are statistically significant (P <0.05) (Table 6). First, the 5% treatment and after one month, then 5% treatment and control were placed in the same range and these values are statistically significant (P <0.05) (Table 7). In the evaluation of odor after 3 months of treatment, control and 5% are at the same level (Table 8). The comparison of the treatments in terms of texture showed that the 5% and 15% treatments are in the same range after three months (Table 9). Measurement of secondary oxidation by malondialdehyde (1000 g) and the best quality of survival (5% and control) are in the same level and the treatment is 15% and the difference is significant (P < 0.05) (Table 10). In terms of measuring the amount of volatile nitrogen in mg / 100 g and the best quality of survival for control treatment and 5%, followed by 15% treatments at a later stage and these data are significant (P <0.05) (Table 11). After three months, by checking the overall count of the control treatment and 15%, they were at the same level and it is statistically significant (P <0.05)

(Table 12). The amount of mold and yeast after three months was assigned the highest score in the control treatment and then in the 15% and 5% treatments, respectively it is statistically significant ($P < 0.05$).

Table 6: Relationship between color assessment and organoleptic score at 4phases time Pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	4.57 ± 0.53^{b}	4.85 ± 0.37^{a}	3.85 ± 0.89^{b}
After a month	4.42 ± 0.53^{a}	4.42 ± 0.53^{a}	4.14 ± 0.89^{b}
After two months	4.14 ± 0.37^{a}	3.85 ± 0.69^{b}	4.14 ± 0.37^{a}
After three months	3.42 ± 0.53^{a}	3.42 ± 0.78^{a}	2.85 ± 0.69^{b}

Table 7: Relationship between odor assessment and organoleptic score at 4phases time Pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	4.57 ± 0.53^{a}	4.57 ± 0.53^{b}	4.14 ± 0.37^{a}
After a month	4.57 ± 0.53^{a}	4 ± 0.57^{a}	4.28 ± 0.95^{b}
After two months	4.42 ± 0.53^{a}	5 ± 0.53^{c}	4 ± 0.37^{b}
After three months	4.14 ± 0.89^{a}	4.14 ± 0.37^{b}	3.14 ± 0.69^{b}

Table 8: Relationship between Texture assessment and organoleptic score at 4phases time Pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	1.48 ± 0.02^{a}	0 ± 0^{b}	0 ± 0^{a}
After a month	2.1 ± 0.14^{a}	0 ± 0^{b}	1.1 ± 0.14^{c}
After two months	2.45 ± 0.07^{a}	1.1 ± 0.14^{b}	1.48 ± 0.01^{c}
After three months	2.61 ± 0.01^{a}	1.13 ± 0.09^{b}	1.61 ± 0.01^{b}

Table 9: Comparison of TBA-rs enriched amount at 4phases time Pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	0.31 ± 0.014^{a}	0.32 ± 0.2^{a}	0.33 ± 0.01^{a}
After a month	0.63 ± 0.021^{a}	0.71±42.73b	0.97 ± 0.03^{c}
After two months	0.87 ± 0.028^{a}	0.93 ± 0.035^{b}	1.23 ± 0.04^{c}
After three months	0.98 ± 0.014^{a}	1.1 ± 0.049^{b}	1.4 ± 0.3^{c}

Table 10: Comparison of TVB-N enriched fillet amount at 4phases time Pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	9.8 ± 0.98^{a}	9.8 ± 0.91^{a}	9.8 ± 0.92^{a}
After a month	11.2 ± 0.90^{b}	12.6 ± 0.98^{b}	16.8 ± 0.98^{c}
After two months	12.6±0.98a	14 ± 0.98^{b}	21 ± 0.98^{c}
After three months	15.4±0.42a	16.8 ± 0.14^{b}	22.4 ± 0.63^{c}

Table 11: Comparison total count of Pasta enriched with fish protein concentrate enriched amount at 4phases time.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	2.31 ± 0.014^{a}	2.05 ± 0.07^{a}	2.15 ± 0.07^{a}
After a month	3.1 ± 0014^{a}	2.485 ± 0.021^{b}	2.95 ± 0.07^{b}
After two months	3.48 ± 0.014^{a}	3.1 ± 0.14^{a}	3.405 ± 0.007^{a}
After three months	3.615 ± 0.21^{a}	2.4 ± 0.14^{b}	3.61 ± 0.014^{a}

Table 12: Comparison of mold and yeast in 4 phases of pasta enriched with fish protein concentrate.

Time	Treatment 1 (control)	Treatment 2 (5%)	Treatment 3 (15%)
Zero phase	1.48[a]	0.0[c]	1.1[a]
After a month	3[a]	0.01[c]	2.35[b]
After two months	3.48[a]	1.1[c]	2.635[b]
After three months	3.61[a]	1.15[c]	2.615[b]

Discussion

The research on the production of pasta enriched using fish protein concentrate from a variety of fish such as silver carp and its use in human diets, especially children, as a valuable protein supplement, plays an important role in providing nutritional needs and increasing the nutritional value will eliminate the protein deficiencies of the community. US Food and Drug Administration (FDA) controlled use of fish protein concentrate as a valuable protein supplement in the diet of humans has been confirmed [6]. According to the Food and Drug Administration (FDA), FPC can be used as a diet supplement in addition to having a good health, its protein content is less than 75% and its fat content is less than 0.5%. Of course, in terms of fat content, The FAO considers a maximum of 0.75% acceptable. In the present study, Protein Concentrate produced from silver carp with a protein content of 91.4% and a fatty acid of 0.63% FPC type A, based on the US Food and Drug Administration (FDA) and FAO, can be used as a source of human nutrition Rich in animal protein. In the current study, in terms of dietary measurements, the percentage of protein and fat in the treatment was 15% higher than treatment 5% and control. In relation to wheat flour enrichment with three sources of vegetable protein, soy protein and fish protein concentrate with ratios of 5 and 10% in bread. The results showed that breads enriched with fish protein concentrates were 10% higher than other treatments which is consistent with the results of this research [7].

Regarding qualitative changes (chemical and sensory evaluation and amino acid profiles) in spaghetti enrichment using protein sources with 100% wheat flour, 25% soy flour + 75% wheat flour, 25% soy flour + 70% flour Wheat, 5% corn flour, 35% soy flour +65% wheat flour, 50% wheat flour + 50% soy flour, showed that the highest percentage of protein was related to treatment 6 (50% wheat flour + 50% soy flour). Which is consistent with the results of this research [8]. In the metabolism and physiological activity of the body, amino acid compounds play different tasks [9]. The decreasing or incremental changes in the amino acid profile observed in this study are due to the stability of the structure of the amino acids in terms of their circular chain count. In this study, 18 types of amino acids were measured from the group of essential amino acids (arginine, lysine, tertounine, methionine, valine, phenylalanine, leucine, tryptophan, isoleucine, histidine) And also from the group of unnecessary amino acids (glycine, alanine, serine, cysteine, aspartic acid, proline, tyrosine and glutamate) Enriched pasta with fish protein concentrate contains a high percentage of protein and amino acids As seen in Table 2-4, most of the amino acids measured in the enriched pasta in treatment 2 (15%), compared to 1 (5%) and the control treatment during 3 months of storage in The temperature of the environment increased significantly with time ($p < 0.05$).

Investigated thalassemia protein concentrate (FPC) enrichment in terms of nutritional value and sensory evaluation [10]. In this study, Tilapia protein concentrate was added to pasta with percentages of 0, 10, 20 and 30%The results of the experiments showed that, by increasing the percentages of concentrate, the amount of amino and protein profiles, total fat, ash, carbohydrate and energy content in pasta was increased, sensory analysis, tissue assay, and the overall acceptance of different percentages of tilapia concentrate in comparison No significant difference was observed with pasta without the addition of Tilapia protein concentrate. Finally, in terms of total acceptance of 20% treatment, the treatment was selected. In the research, chemical analysis (amino acids and nutritional value) and sensory evaluation of FPC enriched flour in 5% and 10% percent were studied. The protein content obtained from FPC was 84.46 and its fat content was 0.23, which was 5% enriched with FPC, its protein was 16.7 and 10% enriched with FPC, protein up to 22.5 increased. Also, the increase of amino acid profiles was done by increasing the FPC percentage in the final product, which is consistent with the present study.

Protein is an essential ingredient for the body, about 15% of which must be made from protein-rich foods such as fish, chicken, and eggs. The US Food and Drug Administration (FDA) has approved the use of controlled fish protein concentrate as a valuable protein supplement in a human diet. Sensory evaluation is used as a measure of the quality of fish during storage. Despite the many efforts made to develop laboratory standards for fish, the best way to evaluate the degree of novelty is still organoleptic testing. Evaluation of organoleptic indices along with chemical experiments (as a complementary method) is necessary to determine the extent of corruption and shelf-life of fish and its products. Sensory evaluation is a suitable method for estimating the shelf life of fish and its products during maintenance. If a product is acceptable in terms of the qualitative parameter but not sensible, it is not suitable for use [11]. Taste is a sensation of the food product and is very effective in accepting the product by the consumer. The benefits of sensory evaluation to other methods are that it does not require laboratory equipment, tests are performed quickly, and samples are evaluated at a relatively short time [12].

Regarding the Organoleptic evaluation of spaghetti enrichment using protein sources with 100% wheat flour, 25% soy flour + 75% wheat flour, 25% soy flour + 70% wheat flour, 5% corn flour, 35% flour Soybeans +65% wheat flour, 50% wheat flour + 50% soy flour

were found to be in texture, in the aggregate of all treatments in a single level and in terms of chewing Grain and solubility of treatment 6 (50% wheat flour + 50% soy flour) are the best treatments. Also, the flavor of spaghetti enrichment treatment with 35.65% wheat flour and soy flour was better than other samples. In a study on macaroni enrichment using fish protein concentrate of tilapia with ratios of 10, 20 and 30 percent of fish protein concentrate and its comparison with control treatment, and in measuring sensory evaluation and flavor, color, and tissue factors in terms of taste and physical changes, treatment with 20% enriched has the best evaluation and is more acceptable. According to the results of this study, the enriched pasta corresponds to 5% FPC [13]. According to Table 10, TBA values increased with increasing the oxidation of lipids in different treatments, which was the lowest in treatment and treatment (1%) and 5% in treatment (15%), in analyzing these results It is possible to reduce the breakdown of fatty acid bands and prevent its hydrolysis.

The magnitude of this index is within the permitted range of 2 milligrams of malondialdehyde per kilogram of dry matter [14]. Only 15% treatment is close to this range at the end of the period And two other treatments with a 15% difference were statistically significant and have lower values In the study of, which was used to enhance the bread's enrichment using FPC, the TBA value increased in the 10% treatment during storage and exceeded the permitted range, However, no significant changes were observed in samples containing lower FPC values In the study of [15], the TBA content during 6 months of storage of FPC from Kilda was increased at ambient temperature significantly during storage, However, this increase was significantly lower in vacuum packed treatments. The results of this study are consistent with the results of other researchers. According to Table 10, TVB-N is generally dependent on microbial activity and microbial degeneration, such that volatile species are produced by the separation of amines from acids by microbial enzymes.

TVB-N is widely used as an indicator of corrosively of the product and usually produces a surface equivalent of 35-40 mg TVB-N per 100 grams [16]. According to the present study, TVB-N values with increasing storage time were increased in all treatments, but this increase in treatment with 2% containing 15% FPC was significantly higher than that of control and treatment 1 containing 5% FPC. Similar results were seen in enriched breads with different percentages of FPC of silver carp. There was no significant difference in the trend of increasing TVN content in 0.5, 2, 5 and 7% of FPC treatments, and 10% treatment showed a significant difference with other treatments [17]. Comparing the results of this study and comparing it with other studies showed that increasing the amount of FPC with values higher than 10% in the increase of TVB-N has a clear and distinct role and, in this regard, our results are consistent with other researchers' findings. However, some researchers have mentioned in their studies that this index cannot be a suitable criterion for judging the novelty of the product [18] According to Table 11 total count the amount of coliform in the control sample was lower in theist month compared to the last three months and increased after three months.

5% treatment in the zero phases and after one month the amount was zero and increased at the same level in the second and third months. 10% in the zero phases, no sample was found, but it showed an increase in the amount of coliform from the first to the third month respectively. As a result, a significant difference was observed. According to Table 12 mold and yeast the number of yeast mold in the control sample was less than the first, second and third months in the zero phase and in the 10% sample it was less in the zero phase and in the first, second and third months with a relative increase, they are almost at the same level. In the 5% sample, in the zero phase of the first month, the amount of mold and yeast did not show any numbers, but it increased at the same level in the second and third months.

Conclusion

According to the results of experiments, food, chemical, sensory, microbial, and amino acid profiles were determined and after statistical tests of the data were determined, However, in terms of nutritional value, the percentage of protein, fat, and amino acid profiles of the treatment with fish protein concentrate was better. However, in terms of taste and shelf-life of the treatment, 5% of the fish protein concentrate was better evaluated and, considering that the taste is at the top of the evaluation, in the overall assessment of the fish protein concentrate enriched with 5% better than the other Samples have been.

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