Biochem. Cell. Arch. Vol. 18, No. 2, pp. 1927-1930, 2018 | www.connectjournals.com/bca | *ISSN 0972-5075*

ESTIMATE OF THE CHEMICAL COMPOSITION AND NUTRITIONAL VALUE OF MUSCLES OF *ACANTHOPAGRUS ARABICUS* AND *OTOLITHES RUBBER* IN BASRAH PROVINCE, SOUTHERN IRAQ

Akeil Jameil Mansour

Department of Biology, Education College for Pure Sciences, University of Basrah, Iraq.
e-mail : aqeelbio2017@gmail.com

(Accepted 6 September 2018)

ABSTRACT : The current study was conduct to estimate of chemical composition of muscles (protein, lipid, moisture, ash and energy value to determined of the nutritional value of two marine fishes; Arabian Yellow fin Sea bream, *Acanthopagrus arabicus* (Iwatski, 2013) and Tigertooth croaker, *Otolithes ruber* (Bloch and Schneider, 1801). Samples were collected from Basrah market in Basrah city, Iraq between December 2017 and February 2018. The results showed a difference in the chemical composition of muscles of studied fish. Protein content ranged between 18.23 – 22.98% while lipid content ranged between 4.24 – 7.67% in the studied species. Moisture content had high averages ranged between 70.47 – 71.30% while there were few averages of ash content, which ranged between 1.62-1.98%. The results revealed significant differences (P< 0.05) in the protein, lipid, moisture and ash content between the studied species.

Key words : *Acanthopagrus arabicus*, *Otolithes rubber*, fish muscles, chemical composition.

INTRODUCTION

Arabian Yellow fin Seabream, *Acanthopagrus arabicus* (Iwatski, 2013), they are Marine and tropical fish, feeds mainly on echinoderms, worms, crustaceans and mollusks (Bauchot and Smith, 1984). Tigertooth croaker, *Otolithes ruber* (Bloch and Schneider, 1801), they are Marine, brackish, benthopelagic and amphidromous fish, adults feed on fishes, prawns and other invertebrates (Sasaki, 2001; Riede, 2004). In the current study, the chemical composition of muscles in these marine fish species was examined due to commercially important and commonly available in Iraqi fish markets and especially in province of Basrah, southern Iraq. Fish are a very important health food due to they are an excellent protein source and various minerals and vitamins necessary for good health (Jan *et al*, 2012). Fish muscles consists of several components, such as protein, lipid, moisture, vitamins and minerals, all of which contribute to the overall muscle composition. These components can differ in nature and quantity according to their function and availability (Love, 1980). On the other hand, there are some endogenous and exogenous factors that affect muscle composition include species, size, life cycle stage and body position (Shearar, 1994; Bosch, 2012) environment, season, organs and also muscle location (Kozlova, 1997; Khitouni *et al*, 2010; Shi *et al*, 2013). Fish protein contains all the essential amino acids that must be provided in the diet in the required ratio and thus has a high nutritional value. The chemical composition of fish can be used to estimate the nutritional value of fish and to plan for the most appropriate industrial and commercial processing (Jan *et al*, 2012). Therefore, the present study aims to know the chemical composition of the studied fish muscles and determine their nutritional value.

MATERIALS AND METHODS

Sampling

Fifty commercially important fish species were chosen and collected for estimation chemical composition of muscles. These were *A. arabicus* and *O. rubber*, they were collected from Basrah market in Basrah city, Iraq between December 2017 and February 2018. They were transported to the laboratory to perform the tests associated with estimating the chemical composition of the studied fish muscles. Protein, lipid, moisture and ash contents were determined in each specimen's muscles according to the (AOAC, 2000) Association of Official Analytical Chemists procedures. The energetic value (calorific value) of fish muscle was estimated by Jabeen and Chaudhry (2011).

Statistical analysis

One - way analysis of variance (ANOVA) was used to compare components of chemical compositions. All statistical tests were performed using the SPSS version 16 between the parameters in both studied fish species. Pearson correlation was calculated for the relationships between the average of total weight and the chemical composition of muscles of studied fishes.

RESULTS

Tables 1, 2 showed the chemical composition of muscles of *A. arabicus* and *O. rubber*. Significant differences ($p< 0.05$) were observed in the chemical composition of muscles between studied species. Therefore, the results indicated that the highest protein content in the *A. arabicus* were ranged between 22.68 – 22.98% and the lowest values was observed in *O. rubber* which ranged between 18.23–18.80%. The statistical comparison between studied species showed significant differences ($P<0.05$) in protein content (Table 3). A positive correlation between the fish weight and protein content in studied species were 0.997 in *A. arabicus* and 0.995 in *O. rubber* (Table 4).

The lipid content of fish muscles also differed significantly ($P< 0.05$) in studied fishes (Table 3). The highest values was observed in *O. rubber* which ranged between 7.35 – 7. 67% (Table 2) whereas the lowest values was found *A. arabicus* which ranged between 4.24 – 4.48% (Table 1). In addition to the results indicated a positive correlation between fish weight and lipid content where recorded 0.996 and 0.966 in *A. arabicus* and *O. rubber*, respectively (Table 4).

The results indicated that the averages of moisture content ranges from 70.72 to 70.47% in *A.arabicus* (Table 1) whereas ranges from 71.64 to 71.30% in *O.rubber* (Table 2), these variation revealed significant differences ($P < 0.05$) between studied species (Table 3), but the results showed a negative correlation between fish weight and moisture content which recorded -0.990 in *A. arabicus* and -0.980 in *O. rubber* (Table 4). A negative correlation was observed between lipid and moisture content of studied species where the correlation values were -0.995 and 0.912 in *A. arabicus* and *O. rubber*, respectively (Table 4).

The highest ash content was observed in *A. arabicus* which ranges from 1.82 to 1.98% (Table 1) whereas the lowest values was found in *O. rubber*, which ranges from 1.62 to 1.86% (Table 2), therefore the statistical analysis indicated significant differences ($P < 0.05$) between studied fishes (Table 3). The results showed a positive correlation between fish weight and ash content which recorded 0.990 and 1.000 in *A. arabicus* and *O. rubber*, respectively (Table 4).

The highest energy values was noticed in *O. rubber*, which were 141.31 Kcal/g and the lowest values was found 129.89 Kcal/g in *A. arabicus* (Table 5). The results showed highest energy value in protein content which recorded 91.28 Kcal/g and 74.08 Kcal/g in *A. arabicus* and *O. rubber*, respectively, but the energy value in the lipid content which recorded 38.61 Kcal/g in *A. arabicus* and 67.23 Kcal/g in *O. rubber* (Table 5).

DISCUSSION

The structural and biochemical characteristics of muscles and their relation to growth performance and nutritional value are a prerequisite for understanding the quality of animal products (Listrat *et al*, 2016). Therefore, the current study was interested in the chemical composition of the muscles of two species of marine fishes to determine their nutritional value by estimating the proportions of protein, fat, moisture and ash in muscle composition.

The present results showed differences in protein content values between studied fishes, where the *A. arabicus* fishes possessed higher values of protein content are comparison with *O. rubber*, these differences could be to several factors such season, size, age and reproducing cycle (Pawar and Sonawane, 2013) sex and season (Younis *et al*, 2015) muscle location (Martins *et al*, 2016). Pawar and Sonawane (2013) found that the values of protein content varied between 24.19 - 32.79% when studied on five teleost fishes. Hantoush *et al* (2015) observed that the values of protein content in Nile tilapia (*Oreochromis niloticus*) ranged between 17.24 - 17.65% while Martins *et al* (2016) noticed the protein content ranged between 17.8 - 18.9% in the Piraruco muscles (*Arapaima gigas*), so the current results are consistent with previous studies.

The Lipid (fatty acid) composition of fishes differs between species and also among individuals of the same species (Budge *et al*, 2002). Patursdoottir *et al* (2008) reported that there are some factors affecting on the lipid composition or fatty acids in fish such as environmental factors such as food habitats, temperature, pressure and salinity. Biological factors such as age, gender, size (Stansby, 1986). Therefore, the current results showed significant differences of lipid content values in the studied fish muscles. These differences may be due to environmental factors and size, age and fish species. According to classification of fish on basis of the values of lipid content by Ackman (1989), the current fishes can be put in a medium lipid fish (4 to 8% lipid).

Table 1 : Chemical composition of muscles of *A. arabicus* (Mean ± SD).

Fish weight	Protein % + SD	Lipid % + SD	Moisture % + SD	Ash % + SD
130.28±15.20	22.68 ± 0.14	4.24 ± 0.12	70.72 ± 0.14	1.82 ± 0.08
170.16±16.35	22.74 ± 0.12	4.30 ± 0.10	70.68 ± 0.08	1.86 ± 0.06
210.28±14.12	22.82 ± 0.13	4.35 ± 0.13	70.62 ± 0.10	1.92 ± 0.08
250.43±11.25	22.92 ± 0.14	4.40 ± 0.14	70.56 ± 0.12	1.94 ± 0.06
290.32±10.24	22.98 ± 0.15	4.48 ± 0.10	70.47 ± 0.15	1.98 ± 0.08

Table 2 : Chemical composition of muscles of *O. rubber* (Mean ± SD).

Fish weight	Protein % + SD	Lipid % + SD	Moisture % + SD	Ash % + SD
200.45 ± 18.26	18.23 ± 0.12	7.35 ± 0.06	71.64 ± 0.12	1.62 ± 0.10
240.28 ± 14.45	18.37 ± 0.10	7.40 ± 0.08	71.50 ± 0.14	1.68 ± 0.08
280.35 ± 15.38	18.56 ± 0.12	7.45 ± 0.09	71.42 ± 0.12	1.74 ± 0.06
320.28 ± 12.75	18.64 ± 0.08	7.52 ± 0.08	71.36 ± 0.10	1.80 ± 0.09
360.34 ± 16.86	18.80 ± 0.12	7.67 ± 0.10	71.30 ± 0.12	1.86 ± 0.08

Table 3 : Statistical analysis of chemical composition of muscles of *A. arabicus* and *O. rubber*.

Parameters	F – values	Significant level	Differences
Protein %	1.415E3	0.000	Significant
Lipid %	2.037E3	0.000	Significant
Moisture %	127.485	0.000	Significant
Ash %	10.281	0.012	Significant

Table 4 : Correlation coefficients between fish weight and chemical composition of muscles of *A. arabicus* and *O. rubber*.

Parameters	*A. arabicus*	*O. rubber*
Protein %	0.997	0.995
Lipid %	0.996	0.966
Moisture %	-0.990	-0.980
Ash %	0.990	1.000
Moisture + Lipid %	-0.995	-0.912

Table 5 : Total averages of chemical composition and energy value of muscles of *A. arabicus* and *O. rubber*.

Parameters	*A. arabicus*	*O. rubber*
Protein %	22.82	18.52
Energy value	(91.28 Kcal/g)	(74.08 Kcal/g)
Lipid %	4.29	7.47
Energy value	(38.61 Kcal/g)	(67.23 Kcal/g)
Moisture %	70.61	71.44
Ash %	1.90	1.74
Total Energy value (Kcal/g)	129.89	141.31

AOAC (1999) reported that the amount or percentage of water within a fish body or muscle is known as moisture content. The moisture content of fish varies between 65 – 90%. Hantoush *et al* (2015) studied the nutritional value of important commercial fish from Iraqi waters and noticed that the moisture content ranging from 71.23% in *Liza abu* to 78.51% in *Cyprinus carpio* – 78% whereas were from 73.74% in *Chirpcentrus dorab* to 79.04% in *Ilishamegal optera*. The current results showed significant differences in the moisture content values of studied species, where *A. arabicus* possessed values ranging between 70.64 - 70.47% while ranging from 71.64 to 71.30% in *O. rubber*. These differences could be to several factors such as weight, length, sex and season. In addition to that the current results indicated an inverse relationship between lipid and moisture content in fish as reported by FAO (1999).

Ash content of fish is associated with body metabolism and feeding habits (Shearar, 1994). Several previous studies have shown differences in ash content values in different fish. Younis *et al* (2015) noted that ash content values in Nile tilapia (*Oreochromis niloticus*) ranged from 1.02-1.30%. Hantoush *et al* (2015) found differences in ash content values of ten freshwater and marine fishes where ranged from 1.28 to 3.25% in freshwater fish and from 1.25 to 4.24% in marine fish. Khitouni *et al* (2014) found differences in ash content values of *Diplodus annularis* fish where ranged from 1.70 to 2.38% in male and female during December, January and February months (winter season), also they noticed that these differences in values of ash content were due to season and sex. Koslova (1997), Khitouni *et al* (2010) noticed that the differences in ash content values may be to endogenous factors such as sex, size, age and muscle location as well as exogenous factors related to ecological variations and season. Therefore, the results showed significant differences in ash content values in current fishes, which may be due to species, size, sex and environmental factors. Song *et al* (2013) noted that the calorific value is the energy scale and an important indicator to measure the level of the primary productivity. The calorific value reflects the change of different physiological activity in growth organizations and the effects of various ecological factors on animal and plant growth. The nutritional components showed variable values in the energy (calories) values of the studied species.

O. rubber fish had higher energy values than comparison with *A. arabicus* fish. These variations may be due to differences of the values of protein and lipid content of these fishes, which reflects the type , quantity and location of muscles (Martins *et al*, 2017). In both studied species, therefore, the results of energy values in current fish muscles are consistent with previous studies as Song *et al* (2013), Jabeen and Chaudhry (2016), Porto *et al* (2016).

CONCLUSION

Current results have shown differences of values of the components of chemical composition of studied fish , these differences may be due to species, size (weight) and muscle location in the body. The current fish put within medium - lipid fish based on lipid content values.

REFERENCES

Ackman R G (1989) Nutritional composition of fats in seafood prog. *Food and Nutr. Sci*. **13** (3-4), 161-289.

AOAC (1999) Estimation of Moisture content (%) in body muscles of selected fishes *Wallago attu* and *Speratamystus seenhala* collected from selected habitats in different seasons (reservoirs) : 90 -104.

AOAC (2000) Official Methods of Analysis of AOAC International, 17th Edition. W. Horwitz (ed.,). AOAC Intl., 2200 pp.

Bauchot M L and Smith M M (1984) Sparidae. In : Fischer W and Bianchi G (eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean (Fishing Area 51). [var. pag.] FAORome.Vol.4 ;http://www.fao.org/docrep/009/ad468e/ad468e00.HTM.

Bosch A C (2012) Investigation of the chemical composition and nutritional value of smoothhound shark (Mustelusmustelus) meat. *M. Sc. Thesis*. University of Stellenbosch : 87pp.

Budge S M, Iverson S J Bowen W D and Ackman R G (2002) Among- and within species variability in fatty acid signatures of marine fish and invertebrates on the Scotian Shelf, Georges Bank, and southern Gulf of St. Lawrence. *Canadian J. of Fish. Aquat. Sci*. **59**, 886 - 898.

FAO (1999) *World production of Fish*. Crustaceans and Molluscus by major fishing areas. Food and Agriculture Organization of the United Nations, Rome, Italy : pp 33.

Hantoush A A, Al-Hamadany Q H, Al-Hassoon A S and Al - Ibadi H J (2015) Nutritional value of important commercial fish from Iraqi waters. *Intl. J. Mar. Sci*. **5** (11), 1 – 5 . doi: 10.5376/ijms.2015.05.0011 .http://ijms.biopublisher.ca

Jabeen F and Chaudhry A S (2011) Chemical compositions and fatty acid profiles of three freshwater fish species. *Food Chemistry* **125**, 991- 996.

Jabeen F and Chaudhry A S (2016) Nutritional composition of seven commercially important freshwater fish species and the use of cluster analysis as a tool for their classification. *Anim. Plant Sci*. **26**(1), 282 – 290.

Jan U, Shah M, Manzoor T and Gaine S A (2012) Variations of Protein Content in the Muscle of Fish *Schizothorax niger*. *Am-Euras. J. Sci. Res.* **7**(1), 01 - 04.

Khitouni K, Abdelmouleh I, Bouain A A and Mihoubi N B (2010) Variations of the chemical compositions of five coastal catch fish species of the Gulf of Gabes (Tunisia). *Cybium* **34**(2), 175-183.

Khitouni I K, Mihoubi N B, Bouain A and Rebah F B (2014) Seasonal Variation of the Chemical Composition, Fatty Acid Profiles and Mineral Elements of *Diplodus annularis* (Linnaeus, 1758) Caught in the Tunisian Coastal Water. *Journal of Food and Nutrition Research* **2**(6), 306-311.

Kozlova T A (1997) Seasonal cycles in total chemical composition of two Lake Baikal benthic-pelagic sculpins (*Cottocomephorus cottoidei*). *J. of Fish Biol*. **50**(4), 734-743.

Listrat A, Lebret B, Louveau I, Astruc T, Bonnet M, Lefaucheur L, Picard B and Bugeon J (2016) How Muscle Structure and Composition Influence Meat and Flesh Quality. *Scientific World Journal* Vol., Article ID 3182746, 14 pages. http://dx.doi.org/10.1155/2016/3182746.

Love R M (1980) The chemical biology of fishes: with a key to the chemical literature. Academic press. London : 387 pp.

Martins M G , Martins D E G and Pena R S (2017) Chemical composition of different muscle zones in pirarucu (*Arapaima gigas*). *Food Sci. Technol., Campina* **37**(4), 651 - 656.

Petursdottir H, Gislason A and Falk-Petersen S (2008) Lipid classes and fatty acid compositions of muscle, liver and skull oil in deep-sea redfish *Sebastesmentella* over the Reykjanes Ridge. *J. of Fish Biol.* **73**, 2485–2496. Doi:10.1111/j.1095-8649.2008.0210.x, available online at attp//www.blackwell.synrgy.com

Pawar S M and Sonawane S R (2013) Fish muscle protein highest source of energy. *Int. J. Biodivers. Concerv*. **5**(7), 433 – 435. DOI:10.5897/IJBC12.043.http://www.academicjournals.org/IJBC.

Porto H L R, De Castro A C L, Filho V E M and Baptista G R (2016) Evaluation of the Chemical Composition of Fish Species Captured in the lower Stretch of Itapecuru River, Maranhão, *Brazil Intl. J. Adv. Agri & Envi., Engg.* **3**(1), 181 – 186.

Riede K (2004) Global register of migratory species - from global to regional scales.Final Report of the R&D-Projekt 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany:329 p.http://www.groms.de/ .

Sasaki K (2001) Sciaenidae. Croakers (drums).p.3117-3174. In : Carpenter K E and Niem V H (eds.). FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific.Volume 5.Bony fishes part 3 (Menidae to Pomacentridae). Rome, FAO. Vol. 5 : 2791-3380. DOI/ ISBN 92-104587-9.http://www.fao.org/docrep/009/x2401e/x2401e00.htm

Shearer K D (1994) Factors affecting the proximate composition of cultured fishes with emphasis on salmonids. *Aquaculture* **119**(1), 63-88. https://doi.org/10.1016/0044-8486(94)90444-8

Shi P S, Zhu Y T, Wang Q, Gu Q H and Xiong B X (2013) Comparison of Nutrition Compositions of Juvenile Paddlefish (*Polyodon spathula*) Fed with Live Feed and Formula Feed. *Turk. J. Fish. Aquat. Sci*. **13**, 271-279. DOI: 10.4194/1303-2712-v13-2-09.

Song K, Sheng Zhao S and Linc C (2013) The Calorific Value and Water Content of Three Kinds of Fish around Zhoushan Archipelago. *Advanced Materials Research* **718-720**, 321-326. doi:10.4028/www.scientific.net/AMR.718-720.321

Stansby M E (1968) Fatty acids in fish. In Health Effects of Polyunsaturated Fatty Acids in Seafood (Martin R E ed.). London: Academic Press : 389 – 401.

Younis E M, Al-Asgah N A, Abdel-Warith A A and Al-Mutairi A A (2015) Seasonal variations in the body composition and bioaccumulation of heavy metals in Nile tilapia collected from drainage canals in Al-Ahsa, Saudi Arabia. *Saudi Journal of Biological Sciences* **22**, 443 - 447. http://dx.doi.org/10.1016/j.sjbs.2014.11.020