

Nutritional value of important commercial fish from Iraqi waters

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Abstract - Knowledge of the proximate chemical composition (protein, fat, moisture and ash) of fish species can be used to determine their nutritional value and to plan the industrial and commercial processing. Ten species of fish from marine and fresh waters of Iraq were studied. In marine and freshwater fish species, the highest level of moisture content was observed in *Ilisha megaloptera* (79.04 %) and *Cyprinus carpio* (78.51 %), and the lowest was observed in *Chirocentrus dorab* (73.74 %) and *Liza abu* (71.23 %). The lipid contents in the muscles of marine fish species ranged from 1.28 % in *Ilisha megaloptera* to 4.63 % in *Cynoglossus bilineatus*, while in freshwater fish species ranged from 3.16 % in *Cyprinus carpio* to 6.03 % in *Liza abu*. The highest protein values in the marine and freshwater fish species were recorded in *Chirocentrus dorab* (18.61 %) and *Liza abu* (19.15 %), and the lower values were in *Cynoglossus bilineatus* (11.77 %) and *Cyprinus carpio* (14.74 %). The percentage of ash content in the marine and freshwater fish species was highest in *Cynoglossus bilineatus* (4.24 %) and *Liza abu* (3.25 %), and lowest in *Ilisha megaloptera* (1.25 %) and *Barbus xanthopterus* (1.28 %). The results showed that the proximate composition of the fish varied significantly among the various fish species. The results revealed that moisture content was high when lipid was low indicating a significant inverse relationship between the two components ($r = - 0.711$).

Keywords: Freshwater and marine fish species, protein, fat, ash and moisture.

Introduction

Fishes are known for their high nutritional value. They are one of the most important sources of animal protein, and have been widely accepted as a source of protein and other nutrients for the human health (Andrew, 2001).

Animal protein containing all essential amino acids, whereas plants generally lack one or more of them (Hoffman and Falvo, 2004). Fish flesh contains varying proportion of water, protein, fat, ash, carbohydrate and other important mineral and vitamins.

Fish have been reported to contain approximately 72 % water, 19 % protein, 8 % fat, 0.5 % calcium, 0.25 % phosphorus and 0.1 % vitamins A, D,

B and C. (Islam and Joadder, 2005). Fish has a distinctive role in Iraqi diets, as it is one of the best food supplying proteins of high biological value (Yesser, 1995).

Fish are an important source of the n-3 highly unsaturated fatty acids (HUFA), eicosapentaenoic (EPA) and docosahexaenoic (DHA) acids (Simopoulos, 1991).

Many fish and shellfish species contain less than 2.5 % of total fat, and only a few species have more than 15 %. A negative correlation between moisture and fat contents has been observed in many aquatic organisms, Ackman (1995) showed that the balance of 80 % of the wet weight for the muscle was made up of lipid and water.

Fish as food, is one of the main sources for protein and fat which can provide high calorific value. Osborne and Voogt (1978) observed that the protein in the diet that is not used to increase the muscle mass may be serving as an energy source.

The aim of this study is to examine the nutritional value of Iraqi commercially important fish.

Materials and Methods

Study fish were obtained from local markets. Fish from local markets are harvested from the Shatt Al-Arab River and the northern Arabian Gulf.

The muscle of six specimens of each of the ten freshwater and marine fish species *Cyprinus carpio*, *Barbus sharpeyi*, *Barbus xanthopterus*, *Liza abu*, *Barbus grypus*, *Cynoglossus arel*, *Ilisha megaloptera*, *Chirocentrus dorab*, *Arius bilineatus* and *Nematalosa nasus* were freeze-dried, ground and sieved.

Percent protein, ash and moisture were determined according to A.O.A.C. (1984). Total lipids were extracted by the method described by I.U.P.A.C. (1979).

All data were calculated on a wet weight basis. The correlation between moisture and fat contents was calculated using ordinary least-squares regression.

Results and Discussion

Tables (1 - 4) summarize the data on fish nutritional values and Table (5) shows comparisons between our data and data on records for Iraqi fishes.

Moisture Content:

The major component of fish was moisture. From Table (1), the maximum moisture contents in freshwater and marine fish species were observed in *Ilisha megaloptera* (79.04 %) and *Cyprinus carpio* (78.51 %), and the minimum contents were observed in *Chirocentrus dorab* (73.74 %) and in *Liza abu* (71.23 %).

Comparison between species showed significant differences in moisture contents. Such variation might also be due to age and size. Some of the data are consistent with those recorded in Table (5).

Lipid Content:

From Table (2), the lipid contents in the muscles of freshwater fish

species ranged from 3.16 % in *Cyprinus carpio* to 6.03 % in *Liza abu*, while in marine fish species it ranged from 1.28 % in *Ilisha megaloptera* to 4.63 % in *Cynoglossus bilineatus*.

The low concentrations of lipid in the muscles of these species could be due to the high metabolism required for spawning (Osibona *et al.*, 2006). Some species contained the same lipid contents while other showed significant differences from each other (Table 5). This is in agreement with the results of Al-Aswad *et al.* (1980); Al-Habbib *et al.* (1986) and Hantoush (1998).

Ackman (1989) found that the lipid content has usually, but not always, been affected by some variations of solvents used in the extraction process. Lipid showed a negative relationship with moisture content of the fish muscle ($r = -0.711$) (Fig. 1).

According to FAO (1999) moisture and lipid contents in fish are inversely related. Their sum is approximately 80% and the other components are accounting for the remaining 20%.

Protein Content:

Table (3) showed that the highest protein values in the freshwater and marine fish species were recorded in *Liza abu* (19.15 %) and *Chirocentrus dorab* (18.61 %), and the lowest values were in *Cyprinus carpio* (14.74 %) and *Cynoglossus bilineatus* (11.77 %). Our results agree well with the results of others in the region (Table 5).

It is important to note that Islam and Joadder (2005) concluded that the highest value of muscle protein was observed immediately after spawning. This might be due to the fact that at the time of spawning, most of the proteins might have been accumulated in the gonads.

The high tissue protein contents may result from the equally high protein content of their diets (fish items, crustaceans, molluscs, algae and diatoms) (Osibona *et al.*, 2006).

Ash Content:

Table (4) showed that the ash contents in the freshwater fish species ranged from 1.28 % in *Barbus xanthopterus* to 3.25 % in *Liza abu* and in the marine fish species from 1.25 % in *Ilisha megaloptera* to 4.24 % in *Cynoglossus bilineatus*.

Ash content is independent of sexual maturity and reproductive cycle (Al-Habbib *et al.*, 1986). The ash content is related to body metabolism and feeding (Jafri and Kawaja, 1968).

There are exogenous and endogenous factors responsible for body composition in fish (Shearer, 1994). The endogenous factors are sex, life cycle, age and size, while the exogenous factors are ecological variations, fishing region and fishing time (Zaitsev *et al.*, 1969). The results of the present study indicated that body composition varied significantly among various fish species.

These variations were attributed to factors such as the geographical area in which the fish was caught, age, size, sexual condition, feeding season and physical activity (Ali *et al.*, 2005).

Table 1. Percentage of moisture content of the muscles of some freshwater and marine Iraqi fish species.

Freshwater Fish Species	Mean (%)	SD	Marine Fish Species	Mean (%)	SD
<i>Cyprinus carpio</i>	78.51	0.63	<i>Cynoglossus arel</i>	78.01	0.55
<i>Barbus sharpeyi</i>	74.97	0.70	<i>Ilisha megaloptera</i>	79.04	0.26
<i>Barbus xanthopterus</i>	76.14	0.27	<i>Chirocentrus dorab</i>	73.74	0.45
<i>Liza abu</i>	71.23	0.69	<i>Arius bilineatus</i>	75.87	0.31
<i>Barbus grypus</i>	73.45	0.63	<i>Nematalosa nasus</i>	75.39	0.74

Table 2. Percentage of lipids of the muscles of some freshwater and marine Iraqi fish species.

Freshwater Fish Species	Mean (%)	SD	Marine Fish Species	Mean (%)	SD
<i>Cyprinus carpio</i>	3.16	0.22	<i>Cynoglossus arel</i>	4.63	0.43
<i>Barbus sharpeyi</i>	3.51	0.25	<i>Ilisha megaloptera</i>	1.28	0.16
<i>Barbus xanthopterus</i>	4.42	0.39	<i>Chirocentrus dorab</i>	3.44	0.23
<i>Liza abu</i>	6.03	0.13	<i>Arius bilineatus</i>	3.72	0.12
<i>Barbus grypus</i>	5.11	0.14	<i>Nematalosa nasus</i>	4.38	0.19

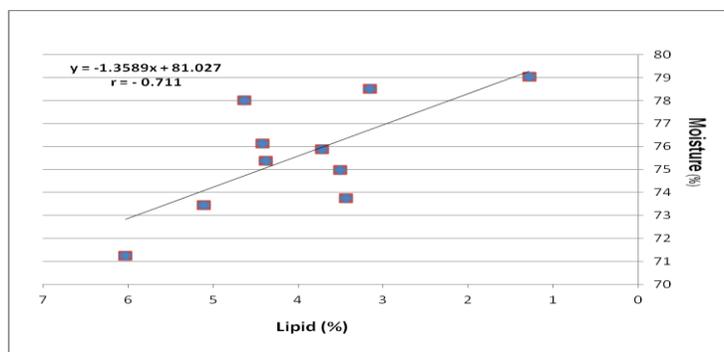


Figure 1. Relationship between moisture and lipid contents in freshwater and marine fishes.

Table 3. Percentage of protein content of the muscles of some freshwater and marine Iraqi fish species.

Freshwater Fish Species	Mean (%)	SD	Marine Fish Species	Mean (%)	SD
<i>Cyprinus carpio</i>	14.74	0.52	<i>Cynoglossus arel</i>	11.77	0.51
<i>Barbus sharpeyi</i>	18.16	1.20	<i>Ilisha megaloptera</i>	17.45	0.50
<i>Barbus xanthopterus</i>	17.56	0.69	<i>Chirocentrus dorab</i>	18.61	0.45
<i>Liza abu</i>	19.15	0.39	<i>Arius bilineatus</i>	17.80	0.67
<i>Barbus grypus</i>	18.69	0.45	<i>Nematalosa nasus</i>	16.58	0.78

Table 4. Percentage of ash content of the muscles of some freshwater and marine Iraqi fish species.

Freshwater Fish Species	Mean (%)	SD	Marine Fish Species	Mean (%)	SD
<i>Cyprinus carpio</i>	3.14	0.36	<i>Cynoglossus arel</i>	4.24	0.64
<i>Barbus sharpeyi</i>	2.65	0.66	<i>Ilisha megaloptera</i>	1.25	0.11
<i>Barbus xanthopterus</i>	1.28	0.27	<i>Chirocentrus dorab</i>	2.61	0.16
<i>Liza abu</i>	3.25	0.11	<i>Arius bilineatus</i>	1.64	0.22
<i>Barbus grypus</i>	2.11	0.22	<i>Nematalosa nasus</i>	2.59	0.34

Table 5. Comparison of the values of protein, fat, moisture and ash of the ten fish species recorded in the present study with those recorded in previous studies.

Scientific name	Local Name	Moisture %	Protein %	Fat %	Ash %	Ref.
<i>Barbus grybus</i>	Shabout	79.79-71.85	19.78-14.70	6.51-4.02	1.58-1.02	Al-Biayati (2000)
<i>Barbus sharpeyi</i>	Bunny	77.59	16.50	3.85	1.26	Al-Az'azi (2002)
		79.40	18.02	1.57	0.89	Mahdi <i>et al.</i> (2006)
		76.10	20.20	2.06	0.89	Mahdi <i>et al.</i> (2007)
<i>Barbus xanthopterus</i>	Gattan	80.30-72.81	22.79-16.40	3.90-1.04	1.81-0.61	Al-Biayati (2000)
<i>Cyprinus carpio</i>	Common Carp	80.94	12.97	5.61	0.96	Al-Hussainy (2007)
		76.85-76.11	14.39-14.22	4.30-4.11	4.41-4.08	Al-Hassoon (2000)
		79.70	13.35	3.09	3.69	Al-Hamdany (2005)
		78.45	18.68	1.36	1.55	Abdul-Naby (2003)
		79.23	15.43	1.53	2.31	Al-Mhnawi (2006)
		79.83	13.26	2.81	3.77	Al-Bedran (2008)
<i>Liza abu</i>	Khishni	75.20	19.00	3.60	1.60	Al-Yunis (2002)
		74.49	17.99	4.51	2.75	Al-Mhnawi (2006)
<i>Arius bilineatus</i>	Chim	78.00-76.00	19.00-18.00	3.50-3.00	1.50-1.00	Yesser (1999)
<i>Chirocentrus dorab</i>	Wolf Herring	75.56	18.39	4.11	1.72	Omar (2003)
<i>Cynoglossus sp.</i>	--	72.11	19.50	6.45	1.35	Ali <i>et al.</i> (2004)
<i>Ilisha megaloptera</i>	Bigeye Shad	78.12	19.18	1.49	1.19	Jasim and Al-Shatty (2002)
		78.26	16.01	6.08	0.97	Al-Hussainy (2007)
		72.11	21.51	2.90	3.20	Jassim <i>et al.</i> (2008)
		73.91	14.01	10.72	0.95	Al-Hussainy (2007)
		76.77	17.42	3.70	2.11	Al-Shatty (2006)
		73.53	18.96	5.68	1.32	Mohamed <i>et al.</i> (2004)
<i>Nematalosa nasus</i>	Thred Herring	73.91	14.01	10.72	0.95	Al-Hussainy (2007)
		76.77	17.42	3.70	2.11	Al-Shatty (2006)
		73.53	18.96	5.68	1.32	Mohamed <i>et al.</i> (2004)

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القيمة الغذائية لبعض الأسماك الاقتصادية في المياه العراقية

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المستخلص - نستطيع من معرفة التركيب الكيميائي (بروتين ودهن ورطوبة ورماد) للأسماك تقدير القيمة الغذائية لها والتخطيط للاستفادة منها صناعياً واقتصادياً. درس التركيب الكيميائي على أساس الوزن الرطب لعشرة أنواع من الأسماك الاقتصادية في المياه البحرية والمياه العذبة العراقية، لوحظ أن أعلى محتوى رطوبة للأسماك البحرية في الصبور *Ilisha megaloptera* (79.04 %) والكارب الشائع *Cyprinus carpio* (78.51 %) على التوالي، وأقل محتوى في الحف *Chirocentrus dorab* (73.74 %) والخشني *Liza abu* (71.23 %) على التوالي. تراوحت نسبة الدهن في عضلات الأسماك البحرية المدروسة من 1.28 % في الصبور *I. megaloptera* إلى 4.63 % في سمك لسان الثور *Cynoglossus bilineatus*، في حين تراوحت هذه النسبة في اسماك المياه العذبة من 3.16 % في الكارب الشائع *C. carpio* إلى 6.03 % في الخشني *L. abu*. سجلت أعلى نسبة بروتين في الأسماك البحرية في الحف *C. dorab* (18.61 %) وأقلها في لسان الثور *C. bilineatus* (11.77 %)، في حين كانت أعلى

نسبة بروتين في أسماك المياه العذبة في الخشني *L. abu* (19.15%) وأقلها في الكارب الشائع *C. carpio* (14.74%). أما نسبة الرماد في الأنواع البحرية فبلغت أعلى قيمها في لسان الثور *C. bilineatus* (4.24%) وأقلها في الصبور *I. megaloptera* (1.25%)، بينما كانت أعلى نسبة رماد في أسماك المياه العذبة في الخشني *L. abu* (3.25%) وأقل نسبة في الكطان *Barbus xanthopterus* (1.28%) على التوالي. أظهرت النتائج اختلاف التركيب الكيميائي بين الأسماك موضوع الدراسة حسب الأنواع، وظهر بأن محتوى الرطوبة كان عالياً عند تدني مستوى الدهون وهذا يدل على العلاقة العكسية بين المكونين ($r = -0.711$).