J.Basrah Researches (Sciences) Vol.31. Part.1. 35 - 40 (2005)

Biochemical constituents and nutritional values for the males and females of the commercial penaeid shrimp *Metapenaeus affinis* (H. Milne -Edwards)

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Received 29/11/2005, Accepted 17/1/2005

Abstract:

The present study is concerned with the biochemical composition: proteins, lipids, carbohydrates, ash, moisture and energy content, of the main parts of males and females of the commercial shrimp *Metapenaeus affinis* (H. Milne-Edwards).The shrimp was characterized by high constituent in protein specially in the flesh (the soft tissue). The percentages of proteins, lipids, carbohydrate, ash, moisture and the value of energy content were 14.356 %, 2.088 %, 8.9035 %, 5.64 %, 69.0116 and 137.350 (cal/gDW) . The analysis showed differences in the contents of the main parts of the body, for both sexes.

Key words: commercial shrimp, *Metapenaeus affinis*, biochemical composition.

Introduction:

The previous publications achieved about shrimp *M. affinis* have great interest for its economical value, in consideration as one of the important sources of food in Arabian Gulf countries and Iraq, one of these studies were Salman *et al.* (1990) their study was about population structure and growth, and other biological sides in Al-Hammar marsh and Shatt Al-Arab River, the researchers have also shown some publications and papers about this shrimp in Arabian Gulf region, while Mathews *et al.* (1986) recorded that the larvae and juveniles of the shrimp found from June to February in Iraqi marshes. Al-Attar (1984) found that the shore of Kuwait is not a nursery ground. The large shrimps found in the period December –April in the Kuwaiti waters (Al-Shoushani, 1985). The industrial shrimp fishery started in the early 1960s, and expanded rapidly, the shrimp landings rose between 4000 and 5000 tons in 1988 and 1989 due to the reduced effort level and good environmental conditions in spring (Fao Fisheries Dept. 1999). Iraqi marshes and Shatt Al-Arab River are a suitable nursery ground, therefore it is well-known that the larvae of *M. affinis* in the north part of Arabian Gulf immigrate up the estuary of Shatt Al-Arab to the Iraqi inland waters (Salman *et al.* , 1990) .These species have reached the maximum density in May (27 ind./100 m^2) and the abundance size between 65-75 mm and between 70-80 mm for the males and females, respectively, the maximum size obtained in Khor Al-Zubeir was 128 mm (Saud, *et al*.,1992) . The moulting of *M. affinis* occurred every two weeks at the time of neap tide (Abdul-Sahib and Sultan, 1996). Previous studies on the biochemical composition of some marine animals in our area, are that on the barnacle *Balanus amphitrite amphitrite* seasonally (Abdul-Sahib, 1999), and on the biochemical composition of some fresh water and marine fishes (Jasim, *et al*.,1999 ;Hantoush, *et al*.,1999; Sahi, *et al*.,1999; Al-Ali, and Jasim,1999) . The present work described the comparisons in the biochemical compositions (proteins, lipids, carbohydrates, ash) and caloric contents in the head, flesh and exoskeleton of the males and females of the commercial shrimp *M. affinis* . The data obtained will be a useful tool in developing shrimp resources, viz., ensure rational utilization of marine food in high nutritional value; utilize the exoskeleton and the head of this shrimp for industry of fodder for animals.

Materials and Methods:

The fresh animals were brought to the laboratory (from Garmat-Ali river), washed, separated to males and females, the total length was measured by using vernire caliper to the nearest 0.02 mm, then selecting one size group (80-90 mm) from each sex content enough

number of specimens, every individual for the two sexes were dissected into the edible part [flesh (soft tissue)] and the non-edible parts [head (the cephalothorax) and the exoskeleton] of the body (plate 1). These parts were weigted to estimate the wet weight, then dried in an oven at 60 ˚C and weigted until a constant weight. Triplicate samples were used for the estimation of total proteins, lipids, ash and moisture. Nitrogen contents were estimated by micro-kjeldahle method (Association of official analytical chemist., 1965), and total protein obtained as N x 6.25. Lipids were determined by the chloroform methanol extraction method (Folch *et al*., 1957). The Ash contents were estimated by combustion in a muffle furnace at 550 ˚ C for 3-4 hr (Jafri, *et al*., 1964). Carbohydrate was expressed as a result of 100 – (protein % + lipid % + ash % + moisture %). Caloric content (Cal / g) was calculated indirectly as follows:

Carbohydrate % x a + protein % x b + lipid % x c

where a, b and c are conversion factors and are equal to 4.1, 5.65 and 9.45 respectively (Brody, 1945).

Plate (1): The three main parts of the commercial shrimp *Metapenaeus affinis.*
[(A) head, (B) flesh, (C) exoskeleton]

Results:

Chemical analysis:

The results of the chemical analysis of the body components of the shrimp *M. affinis* given as a percentage mean of each components (x) and standard deviation (sd ±) for three replicates for each part of the males (Table 1), and for the females are given in table (2) . The main constituent was the protein increment, it is obviously that in the flesh of the two sexes there were more protein than in the head and the exoskeleton and it is the part which is suitable for human consumption. The ash showed an opposite trend, the highest value was in the exoskeleton then in the head. The carbohydrates were ranging between 0.86% and 16.63% for the males, 0.57% and 17.74% for the females. The lipids were ranging from 1.65% to 2.8% for the males, and from 1.69% to 2.39% for the females.

Table (1): The mean weight (x) and standard deviation (sd ±) of protein, lipid, carbohydrate, and ash given as g/ind. of the males of *M. affinis.*

	Protein %	Lipid %	Carbohydrate%	Ash %	Moisture %
Head	x 11.34 sd ± 1.22	2.1 0.43	9.7 0.19	7.05 0.86	69.8 2.33
Flesh	x 19.68 sd ±1.08	1.65 0.74	0.86 0.0215	1.67 0.055	76.14 2.96
Exoskeleton	x 11.31 sd ±1.61	2.8 0.49	16.63 0.32	8.56 0.215	60.7 2.14
Average	14.11	2.183	9.067	5.76	68.88

Table (2): The mean weight (x) and standard deviation (sd ±) of protein, lipid, carbohydrates, and ash given as g/ind. of the females of *M. affinis.*

	Protein %	Lipid %	Carbohydrate%	Ash %	Moisture %
Head	x 12.99 sd ± 1.90	1.9 0.44	7.91 0.26	6.8 0.66	70.4 1.49
Flesh	x 20.32 sd ±1.64	1.69 0.91	0.57 0.068	1.62 0.097	75.8 1.95
Exoskeleton	x 10.5 sd ±1.05	2.39 0.2	17.74 0.73	8.14 0.58	61.23 1.86
Average	14.603	1.993	8.74	5.52	69.143

Generally,the average of the moisture of the two sexes (from table 1 & 2) was 69.0116 %, the protein 14.356 %, the lipids 2.088 %, the carbohydrates 8.9035% and the ash 5.64 %. These two tables (1 & 2) show that the percentages of the moisture play opposite role of that of the lipid in the three main parts of this shrimp, and if we added these two percetages togather it will represent the liquids of these parts .

Caloric contents:

Table (3) shows the caloric contents/ind of the three parts of the males and females of this shrimp .The average values were ranging between 123.754 and 156.582 (cal/gDW) in the head ,flesh and exoskeleton. These values show no significant difference ($P<0.05$).

Table (3): The caloric contents (cal/g DW)/ind. of *M. affinis* .

Parts of shrimp	Energy value (cal/ g DW) for males	Energy value (cal/ g DW) for females	The average of energy value (cal/ g DW)
Head	123.727	123.780	123.754
Flesh	130.311	133.116	131.714
Exoskeleton	158.545	154.619	156.582
Total	412.583	411.515	412.05
Average	137.528	137.172	137.350

Discussion:

The southern Iraqi waters, Shatt Al-Arab and the Arabian Gulf flourish with plenty of shrimp species, but the commercial fisheries concerned with two species only: *M. affinis* and *Exopalaemon styliferus,* and for a balance and healthy food it is very important to know the nutritional values of the commercial marine animals. And these studies need more chemical work to show the effects of pollution in the environment viz. Hydrocarbons pollution, organic matter pollution …..etc. on the biochemical composition to know that if this marine food is still suitable for human consumption or not.The protein ranged between 10.5- 20.32 %, the average was 14.356 %, this value was near for that recorded in Jasim *et al*.(1999) for the same fresh shrimp .The percentages of lipids in the head of the two sexes came mainly from the structure of the reproductive system which exists in this shrimp in the head (cephalothorax), moreover to the lipids in the exoskeleton of the aperture and the intina of the head, the average value of lipids which recorded here near the value that recorded by Douabal *et al*. (1987) (1.1 %), and higher than that recorded by Douabal *et al.* (1988). The high percentage of the ash in the exoskeleton of both sexes is mainly due to the "chitin". The result show little

differences between males and females in almost all the biochemical compositions simply because the two sexes were nearly in the same conditions in many respects: the maturity state, the weight and the length besides there were no ovigerous females between the specimens.

Table (4): A comparison in biochemical compositions for some fishes and shrimps.

Species	Moisture %	Proteins %	Lipids %	Ash %	References
(11) species of marine fishes	77.105	17.515	5.955	1.315	Al-Annaz (1979)
Barbas barbulus (fish)	79.55	17.32	1.8	1.25	Al-Habbib *et al*. (1986)
Barbas sharpeyi (fish)	76.51	19.505	2.825	1.355	Hindi, *et al.* (1989)
Thryssa hamiltonii (fish)	77.76	19.43	1.47	1.42	Yesser (1995)
Arius thalassinus (fish)	75.80	19.40	3.77	1.36	
Nematalosa nasus (fish)	71.535	17.25	9.03	1.545	Hantoush, *et al.* (1999)
Liza subviridis (fish)	72.655	17.745	8.44	1.43	
Otolithes ruber (fish)	74.95	17.93	5.11	1.29	
Cyprinus carpio (fish)	72.995	16.99	7.975	1.28	
Barbus luteus (fish)	75.75	17.32	6.305	1.25	
Metapeneus affinis (The flesh only)	77.38	19.15	1.70	1.77	Jasim *et al.* (1999)
Metapeneus affinis (shrimp)					Present study
1-The head	70.10	12.162	2.00	6.925	
2-The flesh	75.97	20.000	1.67	1.645	
3-The exoskeleton	60.965	10.905	2.595	8.35	

Table (4) shows the biochemical compositions of some freshwaters and marine animals which is suitable for human consumption, it is obvious that all these animals have high percentages of protein exceeded 17 %, suitable percentages of lipids ranged between 1.4 – 9.0 %, acceptable percentages of ash ranged between 1.25-1.77 %, the shrimp *M. affinis* in the present study occupied the first stage in protein and lipids and it is very suitable as human food .

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التركيب الكيمياوي والقيمة الغذائية لذكور واناث الروبيان التجاري *Metapenaeus affinis* (H. Milne -Edwards) في شمال غرب الخليج العربي

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قيست الاختلافات في التركيب الكيمياوي والقيم الغذائية في اجزاء منفصلة من ذكور واناث الروبيان التجاري *Metapenaeus affinis* (H. Milne -Edwards) والتي شملت الرأس والنسيج الطري والقشور. وكانت النسب المئوية للرطوبة والبروتين والدهون والكاربوهيدرات والرماد وقيم محتوى الطاقة كمعدل هي 69.0116 % و14.356 % و 2.088 % و 8.9035 % و5.64 % و137.350 (سعرة/غم وزن جاف) . وبينت النتائج وجود اختلافات بين أجزاء الحيوان الثلاثة (الرأس والنسيج الطري والقشور) بمعدلات النسب المئوية للعناصر الكيمياوية المذكورة، وهناك تباين واضح بين الذكور والاناث .