

**Biochemical composition of the edible parts of the spider crab *Schizophrys aspera* in the Great Bitter Lake of the Suez Canal**

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**ABSTRACT**

Spider crab *Schizophrys aspera* (Brachyura: Majidae) from Great Bitter Lake of the Suez Canal was studied during the spawning season for total edible yield, moisture, total protein, total lipid and total carbohydrate in the edible tissue. Total edible yield, muscle yield and GSI yield in male and female spider crab were compared. Results showed that male muscle yield (32%) was greater than that of female (28%), whereas female GSI yield (5.7%) was higher than that of male (1.3%). No significant differences in total edible yield between both sexes. Regarding to moisture, it was noticed that the muscle moisture (73.5 %) was greater than that of the gonad (69.9 %). Comparing between both sexes, it was detected that male muscle moisture (76.5 %) and male gonad moisture (73.2 %) were greater than that of female (74.9 % and 70.1 %, respectively). Study of the biochemical composition in spider crab showed that gonad had higher protein, lipid and carbohydrate levels than those of muscle. Also, it was noticed that there is a difference between male and female in biochemical composition. Female spider crab showed a higher levels of protein, lipid and carbohydrate than male. The present work concludes that muscle and gonad of this crab contain high level of protein and low level of lipid and carbohydrate. These results suggest that spider crab is healthy for human consumption and is also suitable for processing into different crab products.

**Keywords:** *Schizophrys aspera*, Great Bitter Lake, edible yield, biochemical composition.

**INTRODUCTION**

Crustaceans are high-valued marine resources and are considered luxury sea food items. Crabs are considered to be important shell fishery products and are worldwide consumed as food and feed supplements (Gökoalu & Yerlikaya, 2003). Crab is unique in having easily digestible proteins and essential fatty acids in its composition (Cherif *et al.*, 2008).

Proteins are present in almost all sea food; although often in small amount. The principal nutritional value of proteins is due to the presence of essential amino acids in the edible parts. Lipids play an important role during the development of decapod crustaceans, not only as a source of energy, but also as essential nutrients (Kanazewa *et al.*, 1985).

The spider crab *Maja brachydactyla* showed a commercial importance in Spain, and they used to catch till it is overexploited on the NW coast of Spain. They solve the overfishing problem of this species by aquaculture (Andrés, 2007). The spider crab *Schizophrys aspera* (H. Milne Edwards, 1834) is found in Indo-pacific oceans from South and East Africa to Japan, Australia and Hawaii (Guinot, 1967). It is known as decorator crab. There are many small pieces of sponge, hydroids and barnacles attached to its carapace, legs and chelipeds (Ibrahim, 2007). The biology,

fishery and toxicity of this species have been studied for the first time in Suez Canal (Ibrahim, 2007).

It was caught in Bitter Lake, Suez Canal by fishermen as by-catch of shell fish product (Ibrahim, 2007). Fishermen used to get rid of this crustacean group by breaking them with small hammers to avoid destroying their nets by the large chela and the spine attached to their body. Spider crabs are not commercial species as they are not consumed in the Egyptian fish markets and even are not exported abroad.

No information is available on the biochemical composition of various edible parts of spider crabs. Therefore, the aim of study was to provide information on the edible yield of the spider crab *Schizophrys aspera*. Also, the biochemical composition particularly total protein, total lipids and total carbohydrates of different edible parts were investigated in male and female spider crab. So, this study could demonstrate the nutritional values of the target spider crab for use in human food or as feed in fish farm.

## MATERIALS AND METHODS

Bitter Lake is one of the most important water bodies of the Suez Canal Lakes (Fig. 1).

It contains about 80 % of the waters of the canal system. The study area is laid between latitudes 30°10'-30°26' N, and longitudes 32°10'- 32°40' E. The Great Bitter Lake is about 34 km length with a maximum width of 13 km. The maximum temperature recorded in summer (July and August) was 30<sup>0</sup> C whereas the minimum was 20<sup>0</sup>C in January (Ibrahim, 2007). A total of 150 specimens of adult *Schizophrys aspera* were caught during the spawning season in the period from June to September 2013 by the fishermen as a by- catch. Specimens were collected from the fishing sites in Deversoir, Great Bitter Lake by the crab net operated in this site (Fig. 1). Crabs were preserved in 4% formalin in plastic containers and transported to the laboratory at Marine Sciences Department, Faculty of Science, Ismailia, Egypt. Upon arrival at the laboratory, sexes were differentiated and each crab was weighed to the nearest 0.1 g. using an electric balance.

The muscle yield, gonad somatic index (GSI) and the total edible yield of the crab were calculating using the following formulas:

$$\text{Muscle yield (\%)} = \text{muscle wet weight/ total body weight} \times 100$$

$$\text{GSI (\%)} = \text{gonad wet weight/ total body weight} \times 100$$

$$\text{Total edible yield (\%)} = \text{muscle yield (\%)} + \text{GSI (\%)}$$

The moisture of all specimens was measured by calculating the tissue weight difference after drying in an oven at 105<sup>0</sup> C until constant weight is reached (AOAC, 2012). Total protein (TP) was analyzed using Kjeldahl method according to AOAC procedures (AOAC, 2012). Total lipid (TL) was extracted by chloroform-methanol and quantified using the method described by Folch (1957). Total carbohydrate (TC) content was determined using phenol-sulphuric acid method (Kochert, 1978).

One way analysis of variance (ANOVA) was performed using SYSTAT (V. 10.2.05, 2002) program to determine the relation between total yield, moisture and biochemical composition and both crab sexes. Also, determine significance of biochemical analysis in different edible parts of crab (muscle and gonad).

**RESULTS**

**Total yield**

A total of 150 specimens had been studied to detect the total edible yield, muscle yield and gonado somatic index (GSI). The total edible yield of both male and female spider crab is represented in Table 1. Male muscle yield (32%) was greater than that of female (28%), whereas GSI of female (5.7%) was higher than that of male (1.3%). Generally, one way ANOVA factor showed that there was no significant difference in total edible yield between both sexes.

**Moisture in *S. aspera***

Moisture in male and female crabs are represented in Table 2 and illustrated in Fig. 2 Generally it was noticed that the moisture in the muscle (73.5 %) was greater than that of the gonad (69.9 %). Regarding to sexes, it was detected that male muscle moisture (76.5 %) and male gonad moisture (73.2 %) was greater than that of female (74.9 % and 70.1 %, respectively). One way ANOVA indicates significant difference between moisture of muscle and gonad, also between male and female crabs.

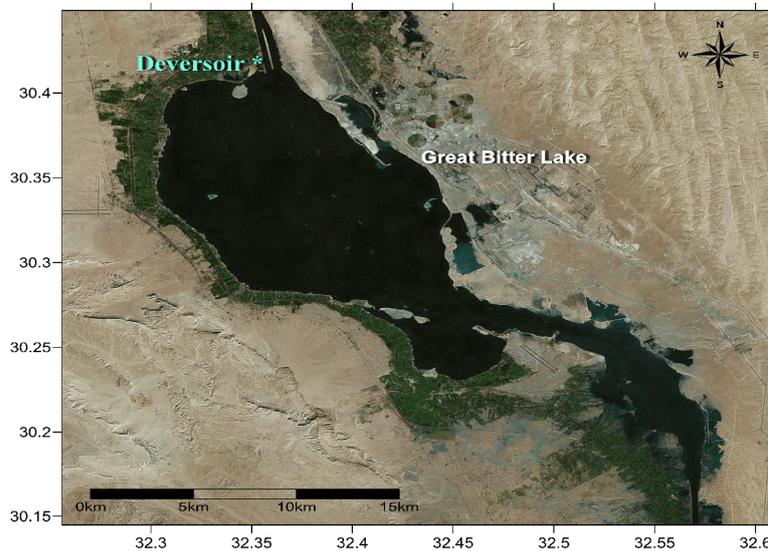


Fig. 1: Map of Great Bitter Lake of Suez Canal

Table 1. Percentage of total edible yield in male and female *S. aspera* in Great Bitter Lake.

Yield %	Sex			
	n	Male Mean ± SD	N	Female Mean ± SD
<b>Muscle</b>	45	<b>32 ± 1.3</b>	50	<b>28 ± 2.3</b>
<b>GSI</b>	25	<b>1.3 ± 0.7</b>	30	<b>5.7 ± 1.8</b>
<b>Total edible part</b>	70	<b>33.3 ± 2.4</b>	80	<b>33.7 ± 1.9</b>

Legend: n = number of specimen. SD = Standard deviation.

Table 2: Biochemical composition in male, female and both sexes of *S. aspera* in Great Bitter Lake.

	Male		Female		Combined sexes	
	Muscle	Gonad	Muscle	Gonad	Muscle	Gonad
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
<b>Moisture %</b>	76.5 ± 1.3	73.2 ± 2.9	74.9 ± 1.3	70.1 ± 1.9	73.5 ± 2.8	69.9 ± 2.2
<b>proteins %</b>	15.7 ± 1.2	22.6 ± 1.7	16.4 ± 2.6	26.5 ± 2.4	16 ± 2.2	25.2 ± 2.8
<b>Lipids %</b>	0.57 ± 0.08	1.08 ± 0.09	0.78 ± 0.04	2 ± 0.05	0.69 ± 0.09	1.88 ± 0.02
<b>Carbohydrate%</b>	0.12 ± 0.02	0.52 ± 0.07	0.15 ± 0.03	0.6 ± 0.06	0.13 ± 0.07	0.58 ± 0.03

SD = Standard deviation

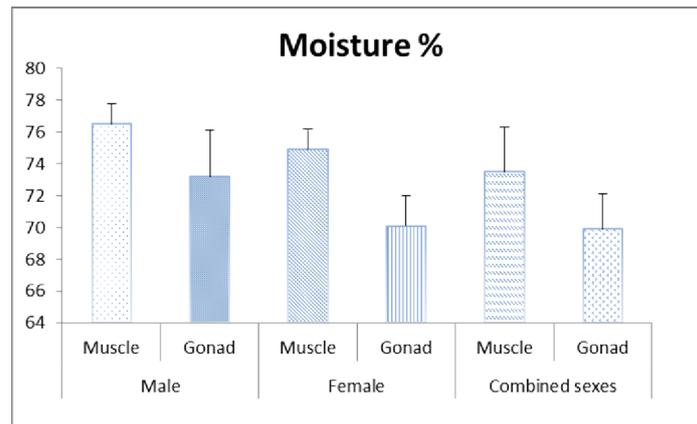


Fig. 2: Moisture in male, female and combined sexes of *S. aspera* in Great Bitter Lake

### Total protein, lipid and carbohydrate

Total protein, lipid and carbohydrate had been represented in Table 2 and graphically illustrated in Figs. 3, 4 and 5. It is clear that the total content of protein, lipid and carbohydrate attained the similar trend. Comparing edible parts, AOVA test showed that gonad had significantly higher protein, lipid and carbohydrate levels than those of muscle ( $p < 0.05$ ). Among sexes, ANOVA test noticed that there is a significant difference between male and female ( $p < 0.05$ ). Female attained a higher levels of protein, lipid and carbohydrate than male.

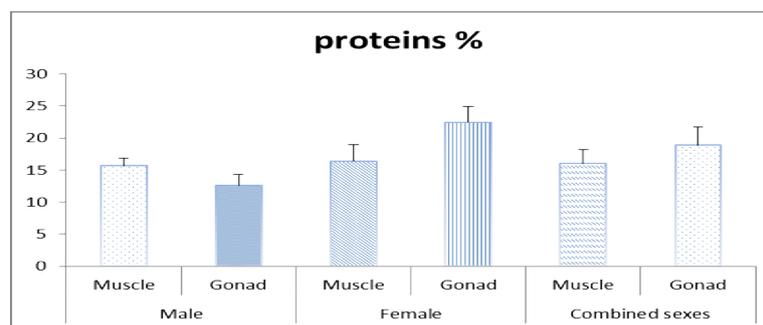


Fig. 3: Protein in male, female and combined sexes of *S. aspera* in Great Bitter Lake

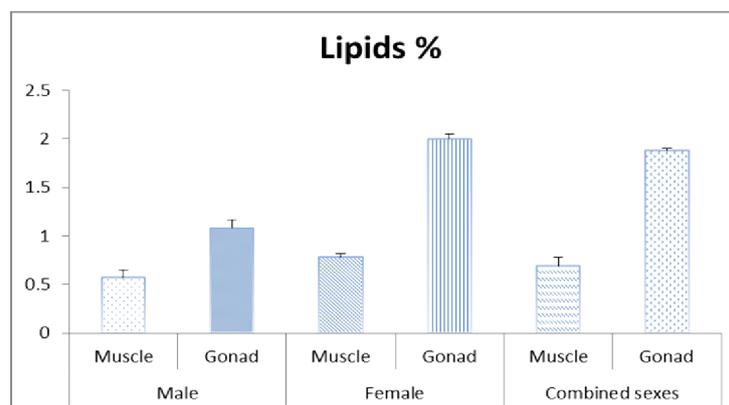


Fig. 4: Lipid in male, female and combined sexes of *S. aspera* in Great Bitter Lake

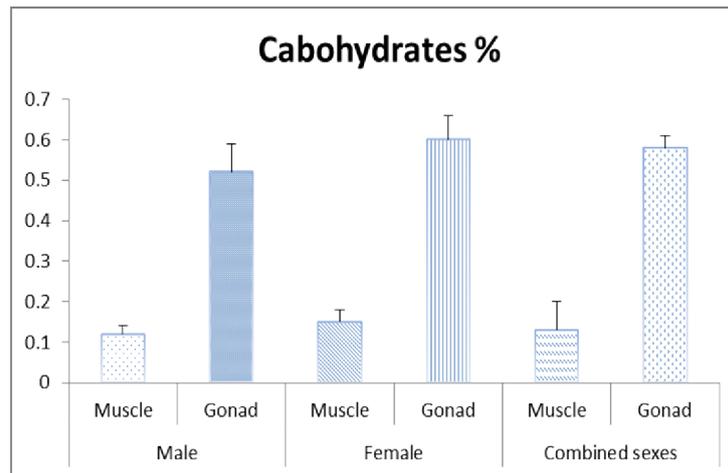


Fig. 5: Carbohydrate in male, female and combined sexes of *S. aspera* in Great Bitter Lake

## DISCUSSION

*Schizophrys aspera* crabs have a considerable amount of total edible yield as that contain in the other edible crabs. Wu *et al.* (2010) studied the total edible yield of the commercial crab *Portunus pelagicus* in both sexes. The male edible yield of *Portunus pelagicus* crab was 35.9%. This is in agreement with the present work, which estimate that the male edible yield in the target species was 33.3%. In contrast, female edible yield of *P. pelagicus* was 44.3% (Wu *et al.*, 2010) whereas in the present work was 33.7% in female *Schizophrys aspera*. The green crab *Carcinus mediterraneus* from the coastal Tunisian water was studied by Cherif *et al.*, 2008. The yield of the combined sexes of *Carcinus mediterraneus* crab showed a mean edible yield of about 34.5% similar to the edible yield of the present study (33.5 %).

Study of biochemical composition in marine organisms give indication about its nutritial value and it is important for human health. Comparing results of the present study with values reported for other crab species shows differences in protein, lipid and carbohydrate composition (Wen *et al.*, 2001. Celik, 2004). These variations could be explained due to the differences in species (Skonberg & Perkins, 2002; Gökoalu & Yerlikaya, 2003, Cherif *et al.*, 2008), sex (Wu *et al.*, 2010), age, nutrient composition of diet, surrounding medium and season (Rosa & Nunes, 2003; Barrento, *et al.*, 2009; Maulvault *et al.*, 2012). Regarding to the present study, total protein was the major constituent of *S. aspera*, it was higher in gonad than in muscle and also in female more than in male. This coincides with the results of Zaghloul (2003) and Vilasoa-Martinez *et al.*, (2007).

Lipids are not only the source of energy but also considered as essential nutrients and play an important role for gonad maturation and brood quality (Soudant *et al.*, 1996; Ying *et al.*, 2004 a,b; 2006). In present study, the muscle of the spider crab has more or less similar total lipid to that of other marine crabs, including the dungenes crab *Cancer magister* (Allen, 1971), the snow crab *Chionoecetes opilio* (Krzycekowski & Stone, 1974), the swimming crab *Portunus trituberculatus* (Su *et al.*, 1996), the mud crab *Scylla serrata* (Tan *et al.*, 2000), the green crab *Carcinus maenas* (Naczka *et al.*, 2004), the blue crab *Callinectes sapidus* (Kuley *et al.*, 2008) and the blue swimmer crab *Portunus pelagicus* (Wu, 2010). Generally, it was concluded that lipid content was accumulated in gonad more than in muscle.

Regarding to carbohydrate content in the crab studied in the present work, it was found low concentration in muscle and gonad of both sexes. So, it could be explained

that this species of crab may use lipid as main source of energy instead of carbohydrate. This explanation is in agreement with the findings of Selvin et al. (1998) and Zaghloul (2003) who stated that carbohydrate content was low in muscle and gonad of the crabs. Blood of crabs stored large quantities of carbohydrate in haemocytes for needs of energy (Selvin *et al.*, 1998). In contrast, Hilmy et al., 1986 indicated that carbohydrate is the major metabolic substrate of crustacea.

## CONCLUSION

The spider crab *S. aspera* collected from Great Bitter Lake, Suez Canal, is not consumed by Egyptian consumers as they are not familiar with it. The present work concludes that muscle and gonad of this crab contain high level of protein and low level of lipid and carbohydrate. These results suggest that spider crab is healthy for human consumption and is also suitable for processing into different crab products.

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## ARABIC SUMMARY

المحتوى البيوكيميائي في الاجزاء المأكولة للسرطان العنكبوتي شيزوفرس اسبرا في البحيرات المرة بقناة السويس

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تمت دراسة السرطان العنكبوتي شيزوفرس اسبرا (مختزلة البطن : ماييدي) في البحيرات المرة بقناة السويس أثناء موسم التكاثر، وذلك لتعيين المحتوى اللحمي الكلي و الرطوبة و البروتين و الدهون و الكربوهيدرات الكلية. تمت مقارنة الجنسين من حيث المحتوى اللحمي الكلي و حجم العضلات و المناسل. و قد أظهرت النتائج أن كمية حجم العضلات في الذكور (32%) أكبر منها في الإناث (28%). أما بالنسبة لحجم المناسل فإنها تبدو في الإناث أكبر حجما (5.7%) من الذكور (1.3%). و اجمالا فإنه لا يوجد اي اختلاف نوعي في المحتوى اللحمي لكلا الجنسين. و عامة فإن كمية الرطوبة في العضلات (73.5%) أكبر منها في الناسل (69.9%) و ان قيمة الرطوبة في عضلات و مناسل الذكور (76.5% . 73.2%) أكبر منها في الإناث (74.9% و 70.1%) على التوالي. و بدراسة التكوين البيوكيميائي قد اظهرت النتائج ان المناسل تحتوي على كم من البروتين و الدهون و الكربوهيدرات أكبر منها في العضلات . و انه قد لوحظ تباين كلا الجنسين حيث ان الإناث تحتوي على بروتين و دهون و كربوهيدرات أكثر من الذكور.