Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 25(3): 491 – 504 (2021)
www.ejabf.journals.ekb.eg

Biochemical composition of some bivalves collected from the western coasts of Suez Gulf, Red Sea, Egypt

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ARTICLE INFO

Article History:
Received: May 30, 2021
Accepted: June 7, 2021
Online: June 12, 2021

Keywords:
Suez Gulf,
bivalve's fisheries,
clams,
edibility,
nutritional value

ABSTRACT

Bivalves are important components of the aquatic fauna. Its consumption has been increasing worldwide during the last decades. The study of biochemical composition is much more important from the nutritional point of view. So, this study was conducted to estimate the percentages of edibility, total proteins, total lipids and total carbohydrates of *Mactra olorina* (Family: Mactridae), *Callista florida*, *Circe rugifera* and *Gafrarium pectinatum* (Family: Veneridae) collected seasonally from the western coasts of the Suez Gulf, Egypt. The results of these parameters showed remarkable seasonal variations for the previous species. For edibility, *M. olorina* recorded the highest value, while *C. rugifera* has the lowest value. The highest annual values of total proteins recorded for *C. rugifera* and *C. florida* averaged 8.58±2.25 %, 8.19±3.87 %, respectively. While total lipids recorded high annual value averaged 5.38±3.49% for *C. florida* and the minimum annual average of 1.90±1.64% for *M. olorina*. Furthermore, the highest annual value of total carbohydrates was 23.46±11.98% for *C. florida*, while the lowest value recorded in *G. pectinatum* (9.16±10.38%). However, this study concluded that *M. olorina* and *C. rugifera* consider as good animal protein source with high edibility percentage and lower lipid content for human consumption.

INTRODUCTION

The biochemical analysis is also known as percentage composition of some fundamental elements like water, protein, lipids, carbohydrates and minerals for human diet (**Ramakrishnan & Venkat rao, 1995**). The main marine invertebrates consumed are those groups conventionally termed "seafood"; that are represented by crustaceans (mainly lobsters, prawns, crabs), bivalves and to a lesser extent gastropod. The edible bivalves and gastropods represent non-traditional and cheap protein supply in many countries; thus, these groups might be considered as a promising food sources (**Mohammad & Yusuf, 2016**). The edible species of marine bivalve mollusks are tasteful, and it will get more importance next to fish and prawn. Marine mollusks are

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economically important species and it is easy to cultivate in coastal regions. Marine mollusks are having leading components of bivalve fishery in aquaculture coastal area (**Jones & Alagarswami, 1973**) and they form an important source of nutrition for coastal folks (**Parulekar *et al*., 1984; Verlecar *et al*., 2006**).

Various factors affecting the proximate composition in shellfishes such as spawning season (**Durve, 1964**), fecundity (**Durve, 1964; Litaay & De Silva, 2003**), and depth of culture area (**Ngo *et al.*, 2006**) have also been investigated (**Qasim *et al.*, 1977; Nagabhushanam & Mane, 1978; Rivonker & Parulekar, 1995**). The knowledge of biochemical composition of bivalves is important as an aspect of quality of seafood and sensory attributes (**Radic *et al*., 2014**). Proteins, lipids, minerals and glycogen contribute to the nutritional value of the soft shellfishes' tissues. These macromolecules together with minerals and minor components of hydrophilic and lipophilic nature, contribute its nutritional value and organoleptic characteristics (**Orban *et al*., 2007**). This means that the bivalves have a good taste and palatable to use by animal or human. The main definitive fact that could be found in the results of most research done on the biochemical composition of bivalves is that the change in protein level, as a main body component fluctuated within certain limits according to species, area, reproductive state and weather conditions.

Protein is the most abundant biochemical component in tissues, and it may be an alternative energy reserve in some shellfishes during gametogenesis (**Galap *et al*., 1997**). On the other hand, carbohydrates have two major biological functions: as long-term energy storage and as structural elements (**Robledo *et al*., 1995**). Shellfish, especially bivalves are not a rich source of animal fats. Lipids represent an important energy reserve because of their high caloric contents. On contrast, the amino acid content varies not only from species to species but also from specimen to specimen and between different tissues. This variation depends upon the environmental conditions and the size of the individual species (**Rose, 2003**).

The present study aims to collect information on the percentage edibility with a view to biochemical composition for the common species of *M. olorina*, *C. florida*, *C. rugifera* and *G. pectinatum* collected from the western coasts of Gulf of Suez.

MATERIALS AND METHODS

1. *Sampling*

Individuals of *Mactra olorina* (family Mactridae), *Gafrarium pectinatum*, *Callista florida* and *Circe rugifera* (family Veneridae) were collected from the soft bottom habitats at two sites along the western coasts of the Gulf of Suez comprising:

1) Kabanon (south Suez City) lies at 32° 29 '12, 02" E, and 29° 56' 37,20" N.
2) Adabia lies at 32°30 '3, 84" E, and 29°50' 46, 41" N.

A total of 79 specimens were collected during the period of summer 2017 to summer 2018, by hand from the upper and lower intertidal zones and shallow subtidal zone. A corer was used for collection of soft bottom subtidal and upper burrowing species. All specimens were placed in ice containers for laboratory investigations.

2. *Biochemical analyses*

2.1. *Percentage edibility*:

Percentage edibility was calculated using Pivot-Table in Excel package and according to **Venkataraman and Chari (1951)** method:

$$\text{Percentage of edibility} = \frac{\text{Wet meat Weight}}{\text{Total Weight with shell}} \times 100$$

Percentage of non-edibility = 100- percentage edibility

2.2. Major organic components

2.2.1. *Determination of total proteins*:

The total proteins were determined using the Colorimetric method (Protein – Biuret Method) described by **Gornal *et al*. (1949)**.

Principle:

In the presence of an alkaline cupric sulfate, the protein produces a violet color, the intensity of which is proportional to their concentration. Read the absorbance of the sample (A_{Sample}) and standard ($A_{Standard}$) against reagent blank at 550 nm (520 – 570 nm).

Calculation:

$$\text{Protein concentration (g /dl)} = \frac{A_{Sample}}{A_{Standard}} \times 5$$

2.2.2. *Determination of total lipids*:

Total lipids were determined using the Colorimetric method described by **Zollner and Kirsch (1962)**.

Principle:

Lipids react with sulfuric, phosphoric acids and vanillin to form pink colored complex. Read the absorbance of sample (A_{Sample}) and standard ($A_{Standard}$) against reagent blank at 545 nm. (530 nm – 560nm).

Calculation:

$$\text{Total lipids concentration (mg /dl)} = \frac{A_{Sample}}{A_{Standard}} \times 1000$$

2.2.3. *Determination of total carbohydrates*:

The determination of total glycogen in the tissues was conducted according to the method of **Carroll *et al*. (1956)**. Glycogen is extracted from the tissues by trichloroacetic acid, precipitated by ethyl alcohol and determined photo electrically by means of anthrone reagent. Read at 620 nm after adjusting the colorimeter with the reagent blank.

Calculation:

Mg of glycogen per 1 gm of tissue

$$\frac{\text{Du}}{\text{DS}} \times 0.1 \times \frac{10}{\text{g tissue}} \times 100 \times 0.9$$

Where Du = Optical density of the unknown.

Ds = Optical density of the standard.

0.1 = mg of glucose in 2 ml of standard solution.

0.9= Factor for converting glucose value to glycogen value.

2.2.4. *Determination of Amino acids*:

The amino acids composition was determined in *Mactra olorina* (Family: Mactridae) and *Callista florida* (Family: Veneridae) only. Determination of amino acids composition was carried out with Ion Exchange Chromatography (IEC) according to **Williams (1988)**.

Principles:

Preparation of total protein by adding 3 ml saturated ammonium sulphate to 1 ml of homogenate, then centrifuged at 3000 rpm for 15 minutes in cooling centrifuge. The protein was then hydrolyses into its amino acids constitutes by using 6 N HCl for 24 hours at 110 C˚. The obtained amino acids were separating and quantifying in protein hydrolysate using automatic analyzer.

RESULTS

1. *Percentages of edibility (%):*

The results in Table (1) show the average values of edibility in *Mactra olorina*, *Callista florida*, *Circe rugifera* and *Gafrarium pectinatum* during this study. It was noticed that the highest values of edibility for the previous mentioned species averaged 53.05±7.89, 37.86±2.04, 24.14±4.36% and 31.19±0.0%, respectively, and were recorded in winter. In contrast, the lowest values averaged 43.51±3.00, 24.30±2.13% and 16.67±1.12% for *M. olorina*, *C. florida* and *C. rugifera* in summer and 15.64±0.40% for *G. pectinatum* in autumn. T-test values have high significant statistical differences between species and seasons ($P<0.01$). These values were also varied between species, and over dominated with *M. olorina* which has the highest annual value of edibility averaged 47.15±4.49%, followed by *C. florida* with 29.81±5.80%, then *G. pectinatum* with 23.96±6.53%, while *C. rugifera* has the lowest annual value averaged 20.67±3.23 % (Table 1). All statistical analyses using t-test showed highly significant differences between species ($P< 0.01$).

2. *Percentages of non-edibility (%):*

Results in Table (1) exhibit both of seasonal and annual values of non-edibility of *M. olorina*, *C. florida*, *Circe rugifera* and *G. pectinatum* during this study. The lowest average values of non-edibility in *M. olorina*, *C. florida*, *Circe rugifera* and *G. pectinatum* were 46.95±7.89, 62.14±2.04, 75.86±4.36% and 68.81±0.0% respectively, recorded in winter. These values increased into the highest values averaged 56.49±3.00, 75.70±2.13% and 83.33±1.12% for *M. olorina*, *C. florida* and *C. rugifera* during summer and to 84.36±0.40% during autumn for *G. pectinatum*. All these values were seasonally fluctuated with significant differences using t-test ($P<0.05$). On the other hand, *M.*

olorina recorded the lowest annual values of non-edibility averaged 52.85±4.49%, *C. florida* came next with 70.19±5.80% then *G. pectinatum* averaged 76.04±6.53%, while the highest annual value was 79.33±3.23% recorded for *C. rugifera* (Table 1). All differences have statistically significant using t-test (P<0.01).

Table 1. Seasonal and annual average percentages of edibility and non-edibility for *M. olorina, C. florida, C. rugifera* and *G. pectinatum* from Suez Gulf during summer 2017 to summer 2018.

Seasons	**Parameters**	**Species**	***Mactra olorina***	***Callista florida***	***Circe rugifera***	***Gafrarium pectinatum***
Summer	**Edibility %**	(Mean ± SD)	43.51±3.00	24.30±2.13	16.67±1.12	22.80±0.0
		Range	40.11-45.78	21.35-25.91	15.73-18.13	22.80-22.80
	non-edibility %	(Mean ± SD)	56.49±3.00	75.70±2.13	83.33±1.12	77.20±0.0
		Range	54.22-59.88	74.09-78.65	81.87-84.27	77.20-77.20
Autumn	**Edibility %**	(Mean ± SD)	43.80±4.51	27.42±0.0	19.70±2.55	15.64±0.40
		Range	38.96-47.88	27.42-27.42	17.46-24.25	15.19-16.29
	non-edibility %	(Mean ± SD)	56.20±4.51	72.58±0.0	80.30±2.55	84.36±0.40
		Range	52.12-61.04	72.58-72.58	75.75-82.54	83.71-84.81
Winter	**Edibility %**	(Mean ± SD)	53.05±7.89	37.86±2.04	24.14±4.36	31.19±0.0
		Range	44.47-60.01	35.76-39.83	19.11-26.83	31.19-31.19
	non-edibility %	(Mean ± SD)	46.95±7.89	62.14±2.04	75.86±4.36	68.81±0.0
		Range	39.99-55.53	60.17-64.24	73.17-80.89	68.81-68.81
Spring	**Edibility %**	(Mean ± SD)	48.26±4.11	29.67±0.04	22.16±5.81	26.20±3.42
		Range	44.00-52.20	29.64-29.70	18.05-36.27	22.80-29.63
	non-edibility %	(Mean ± SD)	51.74±4.11	70.33±0.04	77.84±5.81	73.80±3.42
		Range	47.80-56.00	70.30-70.36	73.73-81.95	70.37-77.20
Annual	**Edibility %**	(Mean ± SD)	47.15±4.49	29.81±5.80	20.67±3.23	23.96±6.53
		Range	38.96-60.01	21.35-39.83	15.73-26.83	15.19-31.19
	non-edibility %	(Mean ± SD)	52.85±4.49	70.19±5.80	79.33±3.23	76.04±6.53
		Range	39.99-61.04	60.17-78.65	73.17-84.27	68.81-84.81

3. *Major organic components*:

Results of total proteins, total lipids and carbohydrates in the bivalves *Mactra olorina*, *Callista florida*, *Circe rugifera* and *Gafrarium pectinatum* are given (Table 2 & Fig. 1). The percentages of these components were greatly varied between these bivalves and showed seasonal variations and represented as following.

3.1. *Total proteins*:

The maximum percentage values of total protein for *C. rugifera* and *G. pectinatum* averaged 11.71±5.38 and 6.89±4.40%, respectively and recorded in spring; while *M. olorina* and *C. florida* had their maximum values averaged 5.59±5.69 and 13.98±0.04% in summer and autumn, respectively (Table 2 & Figure 1a). On the other hand, the minimum value for total proteins declined sharply into 1.32±0.67% during spring for *M. olorina*, while *C. florida* showed closely lower values averaged 6.18±0.29 & 6.05±1.19 during spring and summer, respectively; but both of *C. rugifera* and *G. pectinatum* averaged minimum values averaged of 6.39±4.40 & 2.23±0.01% during autumn and winter, respectively.

Moreover, all maximum and minimum values for these species are given in Table (2). The statistical analyses using ANOVA showed seasonal significant difference in total protein estimated in *Callista florida* only (F=17.356, <0.05), but non-significant in other species. On the other hand, T-test showed significant difference total protein estimated between *M. olorina* versus all species only (P<0.05), but non-significant between the remaining species (P>0.05).

3.2. *Total lipids*:

For total lipids, the highest percentage values averaged 4.16±1.89, 9.55±0.05 and 5.64±2.13 % recorded during autumn season for *M. olorina*, *C. florida* and *G. pectinatum*, respectively, except *C. rugifera* which had the highest percentage (5.12±1.79%) during summer (Table 2). The values of total lipids had declined remarkably into the minimum percentages during winter and averaged 0.65±0.43, 1.25±1.02 and 0.60±0.02 for *M. olorina*, *C. rugifera* and *G. pectinatum*, respectively, but *C. florida* showed closely minimum percentages during summer and winter seasons averaged 2.35±1.42 and 2.66±1.07% respectively.

Furthermore, the maximum annual value for total lipid was 5.38±3.49% for *C. florida* and the minimum annual value averaged 1.90±1.64% for *M. olorina* (Table 2 & Figure 1b). All statistical analyses using ANOVA were significant between season in all species except *C. rugifera* (P>0.05), while t-test values have only significant differences (P<0.05) between *M. olorina* versus both of *C. rugifera* and *C. florida*.

3.3. *Total carbohydrates*:

For total carbohydrates (Table 2 & Figure 1c), the maximum values averaged 36.28±0.02, 30.44±24.26 and 24.24±4.89% for *C. florida*, *C. rugifera* and *G. pectinatum*, respectively recorded in autumn and 15.45±8.99% for *M. olorina* recorded in winter which, was relatively higher than autumn being 13.79±8.46% (Table 2). In contrast, the lowest values averaged 3.20±1.96 and 10.68±2.26% for *M. olorina* and *C. rugifera*, during spring but *C. florida* and *G. pectinatum* showed the lowest values averaged 10.11±3.16 and 1.52±0.01%, respectively, during summer. On the other hand, the annual maximum value was 23.46±11.98%, recorded for *C. florida* (Table 2).

The statistical analyses showed significant differences between season in only *C. florida* and *G. pectinatum* (P<0.05), while t-test values were significant between *M. olorina* against C. *rugifera* and *C. florida*, as well as *G. pectinatum* versus both of *C. rugifera* and *C. florida* (P<0.05).

Table 2. Percentages (mean ±SD) of total proteins, total lipids and carbohydrate of *M. olorina*, *C. florida*, *C. rugifera* and *G. pectinatum* from Suez Gulf during summer 2017 to spring 2018.

Seasons	Parameters	Species	*Mactra olorina*	*Callista florida*	*Circe rugifera*	*Gafrarium pectinatum*
Summer	Total Protein%	(Mean ± SD)	5.59±5.69	6.05±1.19	7.88±6.14	5.58±0.08
		Range	1.56-12.10	4.38-6.91	4.28-17.07	5.52-5.63
	Total Lipids%	(Mean ± SD)	2.06±0.25	2.35±1.42	5.12±1.79	0.90±0.06
		Range	1.77-2.24	1.17-4.14	3.44-6.73	0.85-0.94
	Carbohydrate %	(Mean ± SD)	6.29±1.93	10.11±3.16	23.06±5.64	1.52±0.01
		Range	4.67-8.44	6.19-12.69	18.08-31.17	1.51-1.53
Autumn	Total Protein%	(Mean ± SD)	3.11±1.43	13.98±0.04	6.39±4.40	7.67±3.62
		Range	1.46-4.05	13.95-14.03	1.97-14.08	3.58-12.01
	Total Lipids%	(Mean ± SD)	4.16±1.89	9.55±0.05	3.42±1.96	5.64±2.13
		Range	2.08-5.77	9.50-9.60	1.73-6.80	3.27-8.75
	Carbohydrate %	(Mean ± SD)	13.79±8.46	36.28±0.02	30.44±24.26	24.24±4.89
		Range	4.79-21.58	36.26-36.30	9.03-56.78	20.97-32.8
Winter	Total Protein%	(Mean ± SD)	1.89±0.22	6.56±2.87	8.34±2.42	2.23±0.01
		Range	1.65-2.06	3.33-8.80	5.70-10.45	2.22-2.24
	Total Lipids%	(Mean ± SD)	0.65±0.43	2.66±1.07	1.25±1.02	0.60±0.02
		Range	0.39-1.15	1.43-3.43	0.16-2.20	0.58-0.61
	Carbohydrate %	(Mean ± SD)	15.45±8.99	30.35±8.35	22.28±4.61	7.65±3.53
		Range	7.35-25.11	21.92-38.61	18.18-27.27	5.60-11.72
Spring	Total Protein%	(Mean ± SD)	1.32±0.67	6.18±0.29	11.71±5.38	6.89±4.40
		Range	0.83-2.09	5.97-6.39	7.91-15.52	3.31-11.80
	Total Lipids%	(Mean ± SD)	0.72±0.48	6.95±0.56	3.01±0.42	1.25±0.38
		Range	0.30-1.24	6.56-7.35	2.72-3.31	0.85-1.60
	Carbohydrate %	(Mean ± SD)	3.20±1.96	17.09±3.80	10.68±2.26	3.23±1.81
		Range	1.38-5.27	14.40-19.77	9.09-12.28	1.51-5.12
Annual	Total Protein%	(Mean ± SD)	2.89±1.89	8.19±3.87	8.58±2.25	5.59±2.40
		Range	0.83-12.10	3.33-14.03	1.97-17.07	2.22-12.01
	Total Lipids%	(Mean ± SD)	1.90±1.64	5.38±3.49	3.20±1.59	2.10±2.38
		Range	0.30-5.75	1.17-9.60	0.16-6.80	0.58-8.75
	Carbohydrate %	(Mean ± SD)	9.68±5.88	23.46±11.98	21.62±8.16	9.16±10.38
		Range	1.38-25.11	6.19-38.61	9.03-56.78	1.51-32.80

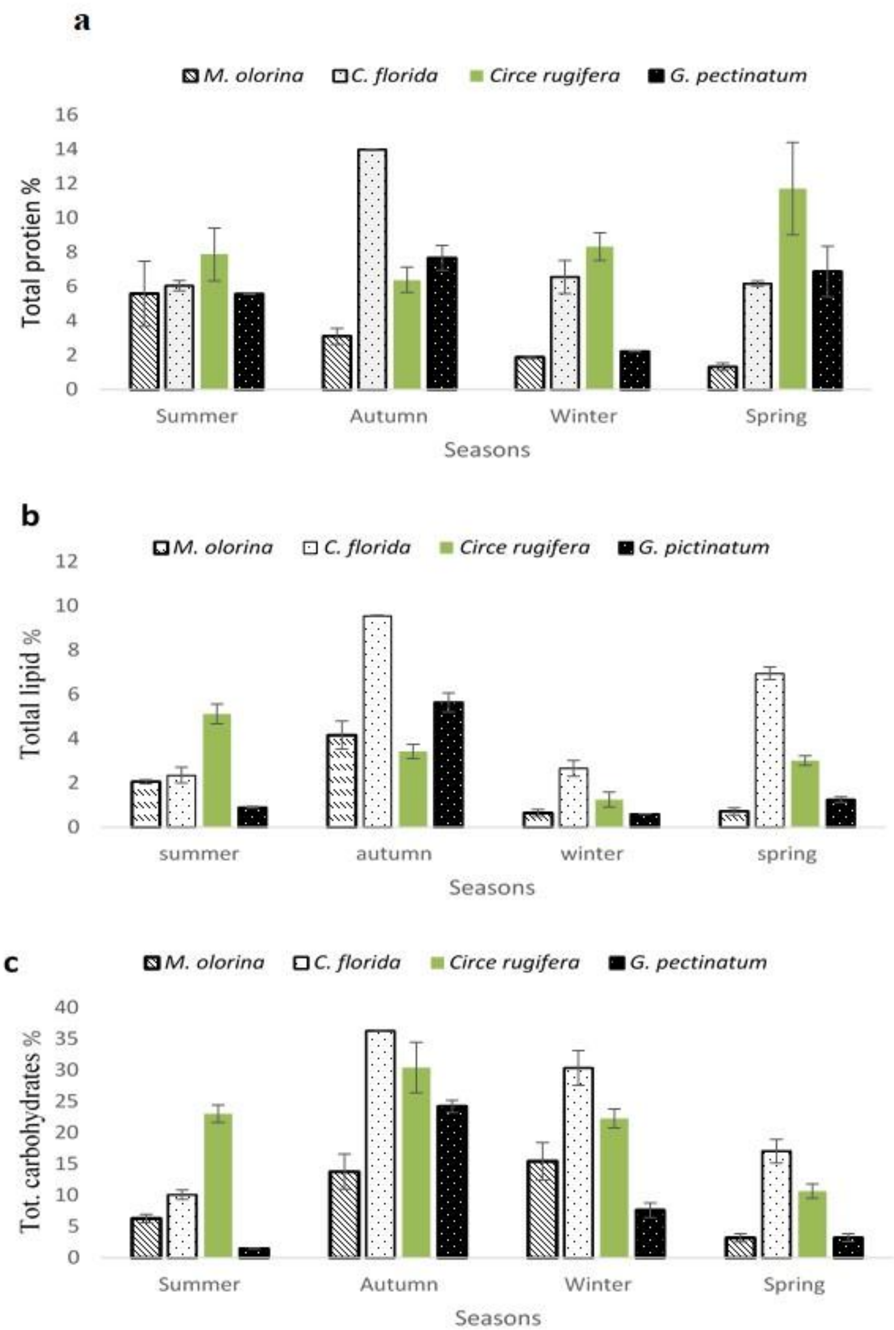

Figure 1. Seasonal averages ±SE of major organic components for selected bivalve species. a) Total protein, b) Total lipids and c) Total carbohydrates**.**

3.4. *Amino acids composition*:

The present study focused on six amino acids in both *M. olorina* and *C. florida* (Table 3), comprised Phenylalanine, Lysine, Tyrosine, Asparagine, Arginine and Tryptophan. Tyrosine was the dominant amino acids estimated and has high percentages of 20.75 and 15.09 % in the two species, respectively. Asparagine, in contrast, recorded the lowest values in the two species, recorded 1.6 in *M. olorina* and1.16 % in *C. florida*. The other four amino acids (Phenylalanine, Lysine, Arginine and Tryptophan) have variable values, but their values were higher in *M. olorina* than *C. florida.*

Table 3. Percentage of amino acids composition for *Mactra olorina* and *Callista florida.*

Species **Amino acids%**	***Mactra olorina***	***Callista florida***
Phenylalanine	5.24	3.81
Lysine	2.95	2.14
Tyrosine	20.75	15.09
Asparagine	1.6	1.16
Arginine	2.03	1.48
Tryptophan	1.71	1.25

DISCUSSION

Marine bivalves are one of the most tasteful mollusk's groups and are economically important species **(Jones & Alagarswami, 1973)**. They consider an important source of nutrition for humans **(Parulekar *et al*., 1984; Verlecar *et al*., 2006)**. Since, known of approximate biochemical composition (proteins, lipids, minerals and glycogen) of marine bivalves is important as contribute to seafood nutritional value **(Radic *et al*., 2014)**. So, the present study investigated these nutritional items for the present selected species seasonally.

The values of total protein were varied seasonally and within species, recorded the maximum values during autumn in *C. florida* (Table 2 & Figure 1) statistically significant (P<0.005), followed by *C. rugifera* during spring but the statistical comparison within seasons was not great enough to confirm this high values (P>0.005). Furthermore *M. olorina* and *G. pectinatum* recorded the maximum values during summer and autumn respectively without significance difference (P<0.005).

However, these variations and differences may be attributed to several factors affecting the biochemical composition in shellfishes such as reproductive season **(Durve, 1964; Ansell, 1967; Litaay & De Silva, 2003)**, depth **(Ngo *et al*., 2006)**, weather conditions, localities and species **(Alferrano, 1954; Ansell, 1974)** and even between size groups in *Venirubes aurea* **(Abu Zied, 1991)**. The annual range of total protein for *M. olorina* in the present results (0.83-12.10%) agree in some extent for congener bivalve, *Mactra violacea*, studied by **Laxmilatha (2009)** in India which, recorded the high value as 11.9 %, and 14% of total wet weight for other bivalve species **(Caroteni & Aloj, 1934)**. While **Mohammad & Yusuf (2016)** recorded 47.10% total protein/dry tissue for *Callista florida* collected from Suez Canal.

For total lipids, the highest values for *C. florida*, *G. pectinatum* and *M. olorina* were recorded during autumn, averaged 9.55±0.05, 5.64±2.13 and 4.16±1.89%, respectively and were statistically significant (P<0.005). But *C. rugifera* recorded the highest value of lipids during summer (3.42±1.96%) without significant difference (P>0.005). These seasonal changes in the maximum value may be related to the previous other environmental factors (e.g., spawning, area, phytoplankton concentrations) as revealed explained by **Ansell *et al*. (1973)**, and **Alferrano (1954)**. However, some species reach highest values just before spawning seasons **(Ansell *et al*., 1980)**, therefore, is an inverse relationship between lipid content and water content **(Ansell 1975)**. Furthermore, in *Donax vittatus,* studied by **Ansell (1972)** the lipid contents decrease consequently during winter but rise again in spring to fulfill the needs of any biological activities during cold season. Noteworthy, the annual nutritional value of lipid estimated for *M. olorina* was 1.90±1.64%, which is higher than that measured by **Laxmilatha (2009)** for *Mactra violacea* (1%) but beings close or relatively lower than those recorded in the foot of *Mactra chinensis* varied between 2.0 and 4.5% **(Li *et al.*, 2011)** and lipid of venerid clam was ranged from 1.11 to 5.63 % *Meretrix casta* by **(Srilatha *et al.*, 2013)**.

Carbohydrates are the major compounds in the bivalve's body; therefore, seafood has high glycogen content and considers as a good quality for marketing species **(Korringa, 1952)**. It is the main reserve in the adult bivalve species **(Gies, 1969)**. In the present study, the total carbohydrates values, showed an obvious increase in autumn for *C. florida*, *C. rugifera* and *G. pectinatum*, respectively. But the highest value for *M. olorina* was recorded in winter and was higher than that recorded in autumn. While the lowest values were recorded during spring for *M. olorina* and *C. rugifera*, and summer for *C. florida* and *G. pectinatum*. The statistical analyses within seasons were significantly different for *C. florida* and *G. pectinatum* (P<0.005), but not significant for *M. olorina* and *C. rugifera* (P>0.005). These seasonal variations were also reported by **Barnes (1963)** and **Ansell & lander (1967**) who studied the seasonal changes in carbohydrate content, indicated that the high carbohydrate content gained in reserve establishment in the second year was more than that needed for spawning and will be utilized during winter months, furthermore, reserve of carbohydrate varies considerably from year to year. However, **Mohammad & Yusuf (2016)** studied proximate carbohydrate content of the dry meat for *Callista florida* collected from Suez Canal and recorded 24.12%. While *Gafrarium divaricatum* reached 24.24±4.89% in the autumn obviously higher than recorded by **Eswar *et al*. (2016)** studied the same species from India (11.23%).

For amino acids evaluation, the present study focused on six amino acids from them one (Asparagine) is non-essential (usually responsible for sweat taste of food); two conditionally essential (Tyrosine & Arginine); and three essential amino acids (Phenylalanine, Lysine and Tryptophan). These are used to evaluate the nutritional quality of food **(Simpson, 1959; Spurvey *et al*., 1998; Babu *et al.*, 2012)**. These amino acids were estimated from *M. olorina* and *C. florida*. It was noticed that, Tyrosine was the dominant amino acids estimated with percentages of 20.75 & 15.09 for the two species, respectively. While Asparagine recorded the lowest values, being 1.6 & 1.16 % for *M. olorina* and *C. florida*, respectively. The other four amino acids, Phenylalanine, Lysine, Arginine and Tryptophan were variables, but their values were higher in *M. olorina* than *C. florida*. On the other hand, comparing the present species amino acids with *Gafrarium divaricatum* investigated by **Eswar *et al*. (2016),** Tyrosine was recorded 3.52% as a low value while, Lysine recorded 14.36% as high value. These results indicate that, amino acids composition varies from species to another.

CONCLUSION

Edible bivalves of families; Mactridae and Veneridae are essential molluscan fisheries components in Suez Gulf represent nontraditional and cheap food source which become economically important species. Moreover, *M. olorina* has the highest edibility percentage followed by *C. florida* but *C. florida* has the high protein value with lower lipid content. So, the present study encourages the coastal aquaculture and fisheries of those species for human consumption.

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Arabic summary

المكونات البيوكيميائية في بعض أنواع المصراعيات المجمعة من غرب خليج السويس بالبحر الأحمر، مصر

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تعتبر المصراعيات من المكونات الهامة للبيئة المائية، كما أن استهلاكها تزايد في جميع أنحاء العالم خلال العقود الماضية. وتعتبر دراسة التركيب الكيميائي الحيوي ذات أهمية من الناحية الغذائية، لذلك أجريت هذه الدراسة لتقدير نسب الجزء اللحمى المأكول والبروتين الكلي والدهون الكلية والكربوهيدرات الكلية لكل لأافراد من أنواع *Mactra olorina* (عائلة Mactridae) و *Callista florida* و *Circe rugifera* و *Gafrarium pectinatum* (عائلة: Veneridae) التي تم تجميعها موسمياً من السواحل الغربية لخليج السويس، مصر. وأظهرت النتائج اختلافات موسمية ملحوظة للأنواع السابقة، حيث سجلت *M. olorina* أعلى قيمة ، بينما سجلت *C. rugifera* أقل قيمة لها. بينما سجلت أعلى القيم السنوية للبروتين الكلي في أفراد نوعي *C. rugifera* و *C. florida* بمتوسط ٨.٥٨ ± ٢.٢٥٪ ، ٨.١٩ ± ٣.٨٧ ٪ على الترتيب. أما قيم الدهون الكلية السنوية فقد سجلت أعلى متوسط (٥.٣٨ ± ٣.٤٩ ٪) في نوع *C. florida* وانخفضت إلى الحد الأدنى (١.٩٠ ± ١.٦٤٪) في نوع *M. olorina*. أما قيم الكربوهيدرات السنوية فقد كانت أعلى (٢٣.٤٦ ± ١١.٩٨٪) في نوع نوع *C. florida* ، وانخفضت إلى أقل قيمة مسجلة في *G. pectinatum* (٩.١٦ ± ١٠.٣٨٪). وقد خلصت هذه الدراسة إلى أن *M. olorina* و *C. rugifera* يعتبران من الأنواع التى تحتوى على بروتين حيواني جيد مع نسبة عالية للجزء المأكول (edibility) ومحتوى دهني أقل، مما يجعلهما من الأنواع الجيدة والصالحة للاستهلاك البشري.