

**Study on chemical Quality and Nutrition Value of Fresh Water
Cray Fish (*Procambarus clarkii*)**

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ABSTRACT

Crayfish are fresh water crustacean that look like a tiny lobster, Fresh water crayfish (*Procombarus clarkii*) had been introduced accidentally and appear in the River Nile and its tributars all over Egypt during the last years. Therefore, the objective of this study to evaluate the chemical quality and composition of crayfish as a human food, and to introduce a new high quality crustacean organism as a new cheap source of animal proteins. Hundred and fifty crayfish samples were collected from different farms in Behera and Alexandria Governorates, and were analysed for total protein, amino acids using amino acids analyzer, fat, cholesterol, fatty acids (using GLC), Ash and minerals using atomic absorption spectrophotometer. Total volatile basic nitrogen, pH, free fatty acids and thiobarbituric acid value as a chemical quality index, were also determined. The obtained results revealed good freshness and high chemical quality of crayfish, with regard to their ranges of total volatile basic nitrogen (49-58mg/100g), pH (5.9-6.2), thiobarbituric acid (0.123-0.637) mg molanaldhyde/kg and free fatty acids (0.93-1.56). Chemical composition and nutritive value of crayfish possessed mean values of total protein, fat, ash and cholesterol contents 13.88%, 1.76%, 1.52% and 13.575mg/100g respectively. Minerals concentrations level were 1.32%, 506.33 and 415.63 ug/g for phosphorous, iron and magnesium respectively. Amino acid pattern showed that Glutamic, Aspartic, Arginine and leucine were abundant essential amino acids and oleic acid represented 44% of total fatty acids. Crayfish showed high nutritional value as respect to higher content of total unsaturated fatty acids (73.689%) with 56.56% and 15.08% monoionic and polyionic (with w₃ and w₆) fatty acids, and also, high quality of protein which contain 55.703% essential amino acids. Also, the present study showed that heavy metals concentration residue decreased in this order zinc > manganese > cadmium > copper > chromium > Nikle > lead. Copper, chromium, cadmium concentration were within the Egyptian permissible limits in all samples, but lead levels exceeded the maximum permissible limits in all samples and zinc exceeded this limit in 75% of examined samples. Results obtained in the present study can be assist in developing quality standard for fresh crayfish in Egypt and recommended rules for it and safety food.

Keywords: Cray fish, chemical quality, nutritive value. .

INTRODUCTION

Crayfish, sometime called crustacean resembling small lobsters (*Procambarus clarkii*). The fresh water crayfish had been
craw fish, are fresh water

introduced to the Egyptian Nile water recently and widely dispersed in all River Nile and its tributaries all over Egypt. It has been collected during fishing from many locations at the Northern parts of the river Nile. (Ibrahima et al., 1996, El Mossalami & Emara, 1999 Fisher, (2006) and Wikipedia, 2006).

Crayfish is a cheap source of protein and sea food similar to the much expensive shrimp and lobster, but much less in price and relatively short life span and fact that they lose the accumulation of heavy metals and chemical when they moult. Crayfish are flavorful nutrition and valuable human food (similar to lobster) and are sold in fish market throughout the world. Every year 75,000 tons valued at over 50 million \$ are produced in U.S.A alone. (Helfrich, and Distelano, 2003 as well as Fisher, 2006)

Crayfish also eaten in Europe and China but they are most popular in Louisiana, consumed in various dishes. They can be prepared like lobster, turn bright red when cooked. Some evidence shows that *Procambarus clarkii* feed well upon some benthic vector

snails, so it might be used as a potential biological *Schistosoma* control agent Wikipedia, 2006 . Also, for new medical problem in Egypt (Faschiola infection in human), Crayfish also are important indicator of water quality and environmental health, flourishing in clean water and perishing in polluted water Fisher, 2006 . The flesh of *P. clarkii* is recommended to stand as a source of animal protein for Egyptian Citizen and its carapace can be used as farage for animals. (Fisher, 2006 and Baheyeldine, 2007).

Thereby crayfish became very important resident in the River Nile areas so, it is necessary to determine the chemical quality and composition of crayfish as a human food, in order to introduce a new high quality crustacean organism and thus adding a new cheap source of animal proteins which we badly need.

MATERIALS AND METHODS

Sampling

Thirty samples (500 gm of each) of fresh water crayfish (*Procambarus clarkii*) were collected a live from different markets in Alexandria. The samples

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were transported to the laboratory Of Arabian and Academic Science and Techenology in isolated ice boxes for various examination. Crayfish are prepared by removing the cephalothorax and then removing the tail meat from the shell only the tail meat with the section of intestine passing through the tail muscles is retained for analysis.

METHODS

I. Chemical quality and composition of proteins parameters were determined:

1. Total protein: according to Pearson (1976), using macrokjeldahl apparatus.
2. Amino acids pattern and ammonia: according to peter (1984), using amino acid analyzer Beckman, model (119 CL).
3. Total volatile basic nitrogen (TVB-N): steam distillation methods as descried by FAO (1986) using kjeldahl macro distillation units.

II. Chemical quality and composition of fat parameters were also determined.

1. Total fat: total lipids were extracted with petrolium ether in asoxhlet apparatus according to Pearson (1976).
2. Free fatty acids: according to AOCS, (1994):
3. Fatty acids profile: The methyl ester of extracted crayfish fat were prepared according to Radwan, (1978) by using Gas liquid chromatography (GLC), GC made shimadzy-4CM (PEE).
4. Cholesterol content: The level of cholesterol was determined colorimetrically according to Bohac, et al. (1988).
5. Thiabarbturic acid value (TBA): Determined calorimetrically according to Pearson (1976), the results were express as malonaldehyde mg/kg samples.

III. Hydrogen ion concentration pH was determined according to

AOAC (1980), it was estimated directly by using a digital genco pH meter (609).

IV. Determination of trace elements and heavy metals residues (Fe,Pb,Cu,Zn,Mn,Cr,Ni and Cd) Digestion: according to Manson and Simkiss, (1983).

Determination of heavy metals residues

Atomic absorption spectrophotometric method used for determination of heavy metals residues as described in perkin Elmer catalogue of atomic absorption model 2380, U.S.A. (1982).

Determination of phosphorous

Phosphorous contents were determined colorimetrically using phosphomolybdate method AOAC, (1980).

Determination of ash content

Ash content was determined according to Pearson (1976).

RESULTS AND DISCUSSION

Total volatile basic nitrogen, pH, Thiobarbituric acid (TBA) value, free fatty acid content and

polyen index are used as chemical quality and freshness index of fish and shell fish (Cobb & Vanderzant, 1975 and Aubourg *et al.*, 1998):

Table (1, 2 & 3) showed that total volatile basic nitrogen, pH, thiobarbituric acid and free fatty acids as indicator on chemical quality of protein and fat of fresh water cray fish were within ES (2005), with mean values of 53.50 ± 1.204 (mg / 100g), 6.05 ± 0.037 , 0.380 ± 0.059 , 1.245 ± 0.05 (mg malonaldehyde / kg), respectively.

Chemical composition and nutritive values of protein and fat of Crayfish

Chemical composition and nutritive values of fish and shell fish are quite variable depending on several factors including species variety and nutritive degree, diet, season of harvesting, local of catching and environmental condition (Tankol, *etal.*, 1999 and Berge *et al*, 2004).

The percentage of the major biochemical constituents of muscles of Cray fish, total protein and fat were illustrated in Tables (1, 2, 3 & 4) and ranged between 1.13 –

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Table (1): Statistical analysis of chemical quality and composition of protein of crayfish (n=30).

| | Total protein % | T.V.N (mg/100g) | pH |
|-----------------|-----------------|-----------------|------------|
| Max | 18.23 | 58 | 6.2 |
| Min | 9.53 | 49 | 5.9 |
| Mean±S.E | 13.88±1.477 | 53.5±1.204 | 6.05±0.037 |

2.45% for total fat and 9.53 – 18.23% for total protein with mean value of 1.76 and 13.88 respectively. This results were in agreement with Holland *et al.*, (1993) and El-Mossalami & Emara, (1999) they recorded that total protein percentage of Crayfish (*Procambarus clarkii*) (15.6, 14.9) and fat percentage (1.51, 0.8) respectively.

Mona, *et al.*, (1999) detected higher percentage of fat, 3.1% and protein 62.2%.

Cholesterol content of crayfish

Table (3) revealed mean value of 13.575 mg/100 g in the context of recommended maximum cholesterol intake of 300-600 mg/day, and the difference was insignificant. Crayfish contain

lowest cholesterol content in compared with egg, prawns, shrimp, lobster, atlantice salmon which contain 250, 195, 130, , 50-100, 56 mg/100 g, respectively (Fish foundation, 2007, Island sea fare, 2007), higher amounts of total cholesterol 47.0±1.5 mg/100 g. Detected by Essien, (1995) in Cray fish *Palaemonets varians*.

Amino acids pattern of crayfish were obvious in Table (2) – amino acids analyzer pattern, detected nine essential and eight non essential amino acid besides ammonia in Cray fish protein. Glutamic, aspartic and arginine were the most abundant and the minor one were theronine, serine, cystine and tyrosine (less than 3%). Total essential amino acids represented 55.703% with respect to the ratio of EAA/NEAA (1.258),

Table (2): Statistical analysis of amino acids pattern and ammonia in crayfish (n = 6).

| Amino acids | Mean ± S.E |
|----------------------|-------------------|
| Aspartic acid | 9.48±0.924 |
| Theronine | 1.494±0.231 |
| Serine | 2.891±0.389 |
| Glutamic acid | 11.207±1.120 |
| Praline | 4.006±0.223 |
| Glycine | 5.815±0.413 |
| Alanine | 5.59±0.521 |
| Cystine | 0.339±0.188 |
| Valine | 6.707±0.620 |
| Methionine | 5.928±0.296 |
| Isoleucine | 6.699±0.178 |
| Leucine | 9.831±6.057 |
| Tyrosine | 2.297±0.110 |
| Phenylalanine | 4.104±0.279 |
| Hidstiadine | 3.0944±0.256 |
| Lysine | 6.462±0.627 |
| Ammonia | 2.639±0.313 |
| Arginine | 11.384±1.48 |
| Essential aminoacids | 55.703 |
| Non essential | 44.297 |
| EAA/NEAA (ratio) | 1.258 |

Each reading represent mean value of 6 trial analysis for polling sample of 5 individual crayfish tissue samples

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Table (3): Statistical analysis of chemical quality and composition of fat of crayfish. (n = 30)

| | Total fat% | Cholesterol mg/100ml | Thiobarbituric acid (mg malonaldehyde/kg) | F.F.A |
|-----------------|------------|-------------------------|---|------------|
| Max | 2.45 | 16.12 | 0.637 | 1.56 |
| Min | 1.13 | 11.03 | 0.123 | 0.93 |
| Mean±S.E | 1.76±0.082 | 13.575±0.781 | 0.380±0.0599 | 1.245±0.05 |

cray fish protein of a high biological quality in compared to ratio of farm, fresh and frozen shrimp recorded by Thanee, et al., (2003) and other protein of high biological values such as beef, egg, and milk.

Fatty acids profiles has been determined using gas liquid chromatography (Table 4), eleven fatty acids were identified, unsaturated fatty acids were found in a very high proportion 73.689%., C₁₆ : 0, C₁₈ : 1, C₁₈ : 2, C₂₂ : 1 were the predominant fatty acid; Oleic acid (18 : 1) represent alone 44.01%.

Biderre, et al., (2000) revealed that oleic acid was prevalent in the fresh water fish and palmitic acid

was prevalent in marine fish, Poly unsaturated fatty acids (omega – 6 and omega – 3) represent 12.5, 2.58% respectively. These fatty acids are essential for good health and normal growth (Sinclair, *et al.* 1998; Bente, *et al.*, 2004). Nearly, the same trends of different fatty acids were showed by Essien, (1995).

Calcium, phosphorus and iron were the essential elements which important for blood, protein, carbohydrates and fat synthesized and acts as coenzymes (Hays 1989) but if excesses causes toxic to biological system (bathwell et al., 1979) Table (5) showed that ash content of *P. clarkii* were 1.52%,

phosphorous, iron and magnesium concentration values were 1.32%, 506.33 and 415.63 ug/g respectively. These results agree with Elmoasalami & Emara, (1999) who detected ash content 1.51%. In contrast with results of Mona, (1999) who found higher ash content (10.2%) and higher phosphorus concentration 3436 µg/g

but detected lower iron concentrations 117 µg/g.

Heavy metals residues

Heavy metals represent the chemical residues which have a major role in animal and human health. These are cumulative poisons causing injury to

Table (4): Statistical analysis of fatty acid profile in crayfish (n=6).

| Fatty acids | Mean ± S.E |
|--|-------------------|
| Lauric C12:0 | 0.531±0.322 |
| Myristic C14:0 | 0.726±0.366 |
| Palmitic C16:0 | 16.53±1.073 |
| Palmitoleic C16:1 | 2.13±0.942 |
| Stearic C18:0 | 5.005±1.097 |
| Oleic C18:1 | 44.01±1.853 |
| Linoleic C18:2 | 12.5±3.092 |
| Linolenic C18:3 | 2.58±0.235 |
| Arachidic C20:0 | 4.59±2.16 |
| Behenic C22:0 | 0.913±561 |
| Erucic C22:1 | 10.42±2.185 |
| Mononeic fatty acids (C_{16:1}, C_{18:1}, C_{22:1}) | 56.56±3.039 |
| Polyoneic fatty acids (C_{18:2}, C_{18:3}) | 15.08±3.196 |
| Saturated fatty acid | 26.311±1.091 |
| Unsaturated fatty acid | 73.689±5.438 |

Each reading represent mean value of 6 trial analysis for polling sample of 5 individual Cray fish tissue.

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health through progressive and irreversible accumulation as a result of ingestion of repeated small amounts. (Bathwell, *et al.*, 1979 & Ahlam El-leboudy *et al.*, 1997). Fresh water cray fish species are considered to be biological indicators of clean water because of their relatively lower locomotory activity in comparison with fish, they lose the accumulation of heavy metals and chemical when they moult. (Guda, 2002).

Concerning the level of heavy metals residues in examined crayfish were illustrated in Table (6). The results obtained revealed that heavy metals concentration level arranged in the following descending order: Zinc > Manganese > Cadmium > Copper > Chromium > Nikle > Lead. with mean values of 64.732 ± 5.689 , 35.176 ± 4.724 , 6.37 ± 0.731 , 3.721 ± 0.241 , 3.68 ± 0.721 , 3.12 ± 0.656 and 1.948 ± 0.192 $\mu\text{g/g}$ wet weight respectively.

In respect to ES (1993) all examined cray fish samples not exceed these permissible limits of copper (20 $\mu\text{g/g}$). Chromium (5.5 $\mu\text{g/g}$) and Cadmium (0.1/ $\mu\text{g/g}$) but zinc exceeded the maximum permissible limit (50 $\mu\text{g/g}$) in 75%

examined samples and lead exceeded this limit (0.1 $\mu\text{g/g}$) 100%.

Results were nearly similar to the level reported by Gouda, (2002) for Cu, Ni and Cd but he recorded lower levels of Zn, Mn and Cr.

In contrast Abd-Allah & Abd-Allah (2006) and Khan *et al.*, (2006) they reported higher level of Cadmium, Lead and Copper exceeding permissible limits and lower level of zinc in raw and cooked muscles of cray fish (*P. clarkii*) with nearly similar descending order of heavy metals concentrations. Also, Mona Hegazy *et al.*, (1999) showed higher Zn concentration value 117mg/kg. Copper (Cu) and Zinc (Zn) are essential metals for Cray fish metabolism, always found in high concentrations independently with their environmental levels and longer exposure time, in contrast Pb, Ni, Cd, Cr tend to increase with increasing concentration in surrounding environment and with longer exposure (Alcarolo, *et al.*, 2006). Generally our results to somewhat nearly to those of Bendell young, (1999), Holdich, (1999), Fang *et al.* (2001), Blasco, *et al.* (2002), Lopez *et al.* (2003), Abdel Maged, (2004) and

Table (5): Statistical analysis of minerals and total Ash in crayfish tissue (n=30).

| | Phosphorous% | Iron µg/g | Magnesium µg/g | Total ash |
|-----------------|--------------|--------------|----------------|------------|
| Max | 1.68 | 605.33 | 469.15 | 1.46 |
| Min | 0.96 | 407.23 | 362.11 | 0.58 |
| Mean±S.E | 1.32±0.21 | 506.33±20.21 | 415.63±18.24 | 1.52±0.138 |

Fatih (2007). These differences may be due to Crustaceans accumulated some heavy metals directly proportional to the increase in bioavailability from water and trophic chain (Guoda, 2002). In general, *P. clarkii* Crayfish revealed

relatively higher or nearly the same level of nutritive value when compared with lobster, shrimp and Atlantic salmon fish due to their higher protein%, minerals contents and low fat%, cholesterol and heavy metals residues as

Table (6): Statistical analysis heavy metals residues in crayfish (ug/g wet weight) (n = 30)

| | Min | Max | Mean±S.E |
|-----------|--------|--------|--------------|
| Pb | 1.216 | 2.680 | 1.948±0.192 |
| Cu | 3.088 | 4.354 | 3.721±0.241 |
| Zn | 51.139 | 78.325 | 64.732±5.689 |
| Mn | 23.881 | 46.471 | 35.176±4.724 |
| Cr | 3.02 | 4.34 | 3.68±0.721 |
| Ni | 2.56 | 3.68 | 3.12±0.656 |
| Cd | 5.05 | 7.67 | 6.37±0.731 |

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discussed by Holland *et al.*,(1993), Thanae, *et al.*,(2003) and Thanae, (2004).

CONCLUSION

The obtained results revealed good freshness and high chemical quality of crayfish, with regard to their ranges of total volatile basic nitrogen, pH, thiobarbituric acid and free fatty acids. Chemical composition and nutritive value of Cray fish revealed that Cray fish is a good source of protein, and minerals with low content of fat and cholesterol. Crayfish evoked high nutritional value as respect to higher content of total unsaturated fatty acids (73.689%) with 15.08% and polyionic (w_3 and w_6), fatty acids also, high quality of protein which contain 55.703% essential amino acids. Copper, chromium Cadmium concentration were within the Egyptian permissible limits in all samples, but lead levels exceeded the maximum permissible limits in all samples and zinc exceeded this limit in 75% of examined samples. Cray fish can provide a pollution-free source of protein, perfectly safe since all the poisonous material absorbed by Cray fish is stored in the shell, which itself shed six times a year.

RECOMMENDATION

Results obtained during the present study can be assist in developing quality standard for fresh crayfish in Egypt and recommended rules as safety food. The Crayfish meat industry is responsible for a 120 million \$ / year impact on Louisiana's economy, if Egypt can develop a similar industry, the profits could be considerable. We think that using Cray fish as a biological snail control agent will represent a much easier cheaper and safer control than the chemical one. Also, Cray fish can be used as a fish meal. In addition, it is of great importance to complete this study by bacteriological and parasitical studies.

REFERENCES

- AOCS. (1994).** the official Methods and Recommended Practices of the American Oil chemists, Society, The American oil Chemists Society:champaign,IL.
- AOAC (1980).** Association of official analytical chemists, official methods of analysis,

- 13th ed. AOAC, Arlinoblon, V.A.
- Aubourg, S. P . Medima, I., Gallardo, J. M.(1998).** Quality assessment of blue whiting *Micromesistis poutassous* during chilled storage by monitoring lipid damage. J. of Agri. And Food Chem. 46:3:662-
- Ahlam, A. EL-Leboudy; Nazem, A.M; Thanaa. M.A. and Fayed, A.H. (1997).** Study on the pollution of fluid milk with some heavy metals.ISSN110-2047.Alex.J.Vet.Science,1997 Vo1.13(546-554).
- Abd-Allah Mohammed, Abd-Allah, Maha. (2006).** Effect of cooking on metal content of freshwater crayfish *Procambarus clarkii*. Chemistry and Ecology, volume 22, Number 4,
- Alcorlo P. Otero M, Gehuet M, Bal Tanas A, Montes C. (2006).** The use of the red swamp crayfish (*Procambarus clarkii*, Girard) as indicator of the bioavailability of heavy metals in environment monitoring in the River Guadiamar (Sul, Spain) Scitolal environ, 366 C11 380-90.
- Abdel Mageed, Z.A.Y. (2004).** Biochemical and biological studies on *Procambarus clarkii* (Girard, 1852), from Egypt. Ph.D. Thesis, Helwan Univ., pp. 236 .
- Blasco J. Arias AM. Saezr. (2002).** Heavy metal concentration in squilla mantis (L.) crustacean, stomatopoda, from the gulf of cadiz evaluation of the impact of the Aznalcollar mining spill. Environ Int. (1-2), 11-6.
- Baheyeldin, K. (2007).** Crayfish introduction to the Nile Delta

CHEMICAL QUALITY AND NUTRITION VALUE OF FRESH WATER CRAY FISH

- and its effects. The Baheyeldin Dynsty. Baheyeldin.Com.
- Bohac, C.E, Rhee, K.S.; Cross, HR. and Kon, O. (1988).** Assessment of methodologies for colorimetric cholesterol assay of meat. J Food Sci., 53: 1642
- Berg, G, M., Benet, R, and Asgard, T.(2004).** Conjugated Linoleic acid in diets for Juvenile Atlantic salmon (*salmo solar*); effects on fish performance, proximate composition, fatty acid and mineral content. Aquaculture 237(1-4) 365.
- Biderre, C.; Babin, F. & Vivares, C. (2000).** Fatty acid. Composition of four microsporidian species compared to that at their host fishes. J. Eukaryotic, Micro. 47 Issue(1): 7-
- Bente, T.E; Livar,F;Robin,O.and Lie, O.(2004).** Tailoring of cardioprotective muscle fatty acids composition of Atlantic salmon (*Salmo Salar*) fed vegetable oils. Food chemistry 87(4),567.
- Bathwell, T.H.; Charlton, R.W.; Cook, J.D. and Finch C.A.(1979).** Iron metabolism in man,pp.82-87.Black WELL,Oxford.
- Bendell Young, L. & Harvey, H. (1991).** Metal concentrations in cray fish tissues in relation to lake pH and metal concentrations in water and sediments, Cand. J. of Zoology 69: 1076-
- Cobb, B.F & Vanderzant, C. (1975):** Development of chemical test for shrimp quality, J. Food Sci. 40: 121-
- Elmossalami M.K. & Emara M.T. (1999).** Safety and quality of fresh water crayfish *Procambarus clarkii* in river Nile. Nahrung. 43(2): 126-8.

- Egyptian organization for standardization and quality control (2005).** ESN^o. 889.
- Essien, E.U. (1995).** Lipid content and fatty acid profiles of some lesser known Nigerian food. *Journal of food biochemistry* Vol. 19 Issue (3) 153.
- Egyptian organization for standardization and quality control (1993):** Maximum level for heavy metal contaminants in food. ES N^o 2360.
- Fishar, M.R., (2006).** Red swamp, crayfish (*Procambarus clarkii*) in River Nile Egypt. Biodiversity Monitoring and Assessment Project (Bio Map) Nature conversion sector
- FAO, (1986).** Manuals of food quality control, food analysis, quality adulteration and test identify P. 156.
- Fish foundation (2007).** Fish-foundation.org.uk/micronutrients.htm.
- Fang ZQ, Cheuing RY, Wong MH. (2001).** Heavy metal concentrations in edible bivalves and gastropods available in major markets of renal River Delta. *J. Environ Sci (China)*. 13 (2) 210-7.
- Guoda, M. (2002).** Bioaccumulation of heavy metals in noble crayfish tissues under aquaculture condition. ISSN 0235-7224, *Ekologija* (Vilnius
- Hays, A.W. (1989).** Principals and methods of toxicology. 2nd ed. Raven Press, New York Chap 9, p89-115.
- Holland, B., Brown J., Buss, P.H., (1993).** Fish and Fish products, the third supplement to McCance & Widdowson's. The composition of food (5th edition), HMSO, London.

CHEMICAL QUALITY AND NUTRITION VALUE OF FRESH WATER CRAY FISH

- Holdich, D.M. (1999).** Heavy metal exposure, Biology of fresh water crayfish Ed. by David M. Holdich-Bakwell science p.420
- Helfrich, A.F. & Distelano, J. (2003).** Crayfish Biodiversity and conservation, Sustaining American Aquatic Biodiversity, No 420-524.
- Ibrahim, A.M., Khalil, M.T. and Mubarak, M.F. (1996).** Ecological studies on the Exotic crayfish, *P. clarkii* and *P. zonangulus* Hibbs & Hobbs, 1990 in the River Nile, Egypt. J. Egypt. Ger. Soc. Zool., Vol: 20(D): 167 –
- Island sea fare, (2007).** Healthy Eating, understand the health benefits of eating Island sea fares fresh sea food. Google's Cache of <http://www.islands-seafar-co.uk/shealthyeating.aspx>.
- Lopez FJ, Garcia MD, Marito NP, Vidaly L. (2003).** Determination of heavy metal in crayfish by ICP-MS with a microwave-assisted digestion treatment. Ecotoxical Enviro Saf. 54 (2) 223-8.
- Mason, A. Z and Simikiss K. (1983).** Interaction between metals and their distribution in tissues of Littorina Littorina (1) Collected from clean and polluted sites. J. Mar. Biol. Ass. U. K. 63: 661-672.
- Mona, A. Hegazy.; Geasa, N.M. Sh.; Sharshar, Kh. M. and Morsy, E.M. (1999).** Chemical composition of freshwater crayfish (*Procambarus clarkii*) and its nutritive value. Egypt. J. Aquat. Biol. And Fish., 4(1) : 19 – 34.
- Pearson, D. (1976).** The chemical analysis of food 7th, ed. Oil and Fat. Ch. 19. J. and

Churchill 109 Gloucesterplace,
London.

- Peter, L., Pelletl and Verman R. Young (1984).** Some chemical and microbiological assay, procedures for the evaluation of protein quality nutritional evaluation of protein foods Ch. 8P 89. The United Nations university world hunger programme food and nutrition Bullation supplement 4.
- Radwan, S. S. (1978).** Copling of two dimension thin layer chromatography with gas chromatography for quantities analysis of lipid classes and their constituent fatty acid, J. Chromatography Sci, 16: 538.
- Sinclair, A. J.;Oon. K. S.;Lim,L; DuoLi, and Mann, N.J.(1998).** The w-3 fatty acids content of canned. Smoked and fresh fish in Australia, J.of Nutri. And Dietics.55:116.
- Tanakol, R,Yazici, Z., Sener, E,Sencer,E.(1999).** Fatty acids composition of 19 species of fish from the black sea and the marmara sea. Lipids, 34:291.
- Thanae M Amine. (2004).** Lipid quality, fatty acids composition and cholesterol content of frozen and smoked Atlantic Salmon (*Salmo salar*) Alex. Vet Science, Vol 21 NO (2-4) 560-.
- Thanae M. Amina, Mona O. Abou EL Nil and Azza, M. Abaul Wafa. (2003).** Quality of fresh and frozen shrimp in Alexandria City. 3rd Inc Sci Conf. Mansoura. (29-30) 1141-
- Wikipedia, (2006).** Crayfish, Wikipedia, CD selection.

التقييم الكيميائي والقيمة الغذائية لاستاكوزا المياه العذبة

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الاستاكوزا نوع من أنواع قشريات المياه العذبة ويطلق عليها استاكوزا المياه العذبة حيث دخلت بالصدفة بطريقة الخطأ لنهر النيل وفروعة على مستوى مصر فى السنوات الأخيرة .

الهدف من هذه الدراسة هو عمل تقييم كيميائي لمكونات وجودة استاكوزا المياه العذبة كغذاء للإنسان ومن أجل إدخال أنواع من القشريات عالية الجودة وكمصدر جديد ورخيص للبروتين الحيواني . حوالى 150 عينة من استاكوزا المياه العذبة تم تجميعها من مزارع مختلفة من محافظات البحيرة والإسكندرية وتم تحليل البروتين الكلى والأحماض الأمينية والدهون والكوليستيرول والأحماض الدهنية والرماد والمعادن باستخدام الاسبيكتروفوتوميتر .

أيضا تم قياس النيتروجين المتطاير والأس الهيدروجيني والأحماض الدهنية الحرة وحمض الثيوباربيتوريك كمقياس للجودة الكيميائية والنتائج المتحصل عليها أظهرت طزاجة عالية وكذلك قيمة كيميائية عالية للاستاكوزا .

حيث كانت نسبة النيتروجين المتطاير تتراوح من 49 - 58 جم / 100 جرام ودرجة الأس الهيدروجيني من 5.9 - 6.2 وحمض الثيوباربيتوريك 0.123 إلى 0.637 مجم مولا أدهيد / كجم وقيمة الأحماض الدهنية الحرة من 0.93 - 1.56 .

التركيب الكيميائي والقيمة الغذائية للاستاكوزا وضحت ان متوسط البروتين الكلى والدهون والرماد والكوليسترول كانت 13.88% و 1.76% و 1.52% و 13.575% مجم / 100 جرام . أما المعادن فكانت النسبة 1.32% و 56.33% و 415.63 ميكروجرام / جرام للفوسفور والحديد والماغنسيوم . أما بالنسبة للأحماض الأمينية : نسبة حمض الجلوتامك وأسبارتك والأرجنين والليوسين تعتبر من الأحماض الأمينية الأساسية والأوليك أسيد وصلت النسبة إلى 44% من الأحماض الدهنية الكلية .

مما سبق يتضح ان : الاستاكوزا تعد ذو قيمة غذائية عالية وبها نسبة عالية من الأحماض الدهنية الغير مشبعة 73.689 منها 56.56% و 15.08% من أوميغا 3 و 6 أحادية ومتعددة الأيونات للأحماض الدهنية كانت تحتوى أيضا على نسبة عالية من البروتين عالية الجودة (55.703% من الأحماض الأمينية الأساسية) . أيضا نسبة المعادن الثقيلة كانت قليلة بشكل ملحوظ حيث الزنك أعلى من الماغنسيوم أعلى من الكاديوم أعلى من النحاس أعلى من الكروم أعلى من النيكل أعلى من الرصاص . حيث كانت تلك المعادن فى داخل الحدود المصرية المسموح بها فى كل المعادن لكن الرصاص زاد عن ذلك فى كل العينات المفحوصة أما الزنك زاد فقط فى 75% من العينات المفحوصة . من هذه الدراسة نستخلص أن استاكوزا المياه العذبة تعد من الكائنات المائية ذو الجودة الغذائية العالية وينطبق عليها كل المقاييس والمعايير الصحية السليمة الصالحة للاستهلاك الأدمى