JOURNAL OF VETERINARY MEDICAL RESEARCH, 2019, 25 (x): xx-xx

Journal homepage:
http://www.bsu.edu.eg/bsujournals/JVMR.aspx

Online ISSN: 2357-0520 Print ISSN: 2357-0512

Original Research Article

# Physicochemical and bacteriological status of retail-marketed shrimps and crabs in Beni-Suef, Egypt

**Fatma H.M. Ali[a], Abdelrahim H.A. Hassan[a*], Gehan M. Oaf[b] and Ahmed A. Elmasry[c]**

[a]*Department of Food Hygiene, Faculty of Veterinary Medicine, Beni-Suef University, Beni-Suef, Egypt.*

[b]*Department of Food Hygiene, Animal Health Research Institute, Dokki, Giza, Egypt.*

[c]*Department of Food Hygiene, Animal Health Research Institute, Beni-Suef, Egypt.*

***ABSTRACT***

A total of a hundred and twenty samples of crustaceans, 60 samples of shrimp (30 peeled & 30 unpeeled shrimps) and 60 samples of local chilled crab were collected from Beni-Suef markets. Collected samples were evaluated by the physicochemical deteriorative criteria (pH and TVB-N), the bacterial load determination (mesophilic count, psychrophilic count, Staphylococcus aureus count and MPN of coliforms, faecal coliforms and E. coli), and isolation and identification of specific pathogens (E. coli, and Staphylococcus aureus). Xxxxxxxxxxx. All fresh and frozen seafood samples were judged as safe food from microbiological point of view. The total mesophilic, psychrophilic and S. aureus for all examined seafood samples lies within the standard permissible limits recommended by …….. . The suggestive measure for produce high quality shrimp & crab was recommended.

***ARTICLE INFO***

***Article history:***

Received:

Accepted:

Online: 3/ 2019

***Keywords:***

Shrimp, Crab, APC, Staphylococcus aureus, E. coli, TVB-N

* Corresponding author:*Department of Food Hygiene, Faculty of Veterinary Medicine, Beni-Suef University, Beni-Suef, Egypt* , Email: abdelrahim@vet.bsu.edu.eg

## 1. Introduction

Seafoods, including crustaceans, represent an important part of a healthful diet due to their high-quality protein content, vitamins, minerals and high levels of polyunsaturated fatty acids named omega-3 fatty acids **(Okonko et al., 2009)**. Besides, the seafood proteins are easily digestible because of their less connective tissue **(FDA, 2009).** On the other hand, seafoods including crustaceans are highly perishable due to less acidic muscle pH, highly active muscular enzymes and high levels of unsaturated fatty acids, consequently they are susceptible for microbiological, chemical, and physical changes during postmortem storage **(Nirmal and Benjakul, 2010).** In addition, they are subjected to contamination at during various stages of handling and processing. Raw sea food products, water and utensils used may lead to contamination of seafoods **(Inabo et al., 2000),** Processing and packaging are done mainly by workers with poor sanitary conditions **(Oranusi et al., 2003).** The quality deterioration of sea foods can be assessed by sensory evaluation**,** chemically by pH, as well as bacteriologically by enumerating spoilage microorganisms especially Coliforms, Pseudomonas**,** isolation and identification of pathogenic microorganisms **(Zuberi et al., 1981; Chen et al., 1990; Ramachandran et al., 1997 and Al-Dagal et al., 1999).** Several reports recorded that contamination of seafood with *Staphylococcus aureus* , *coliform* bacteria and others lead to health risks ranging from allergy reaction, stomach and intestinal growths, a general degeneration of peripheral cellular tissues, to gradual break down of the digestive and excretive system, abdominal cramps, vomiting, chills and fever **(Acha and Szyfres,1991; Varnam and Evans, 1991; Gracey et al., 1999; Ekholm and Hirshfield, 2001; Edema et al., 2005)**. So far, there have been many studies on the microbiological quality of Crustacean **(Ray et al., 1976; Ward et al., 1977; Wents et al., 1985; Gecan et al., 1988; Ingham et al., 1990; Segner, 1992; Chung and Cadwallader, 1993; Chen et al., 1996; Gimenez and Dalgaard 2004; Fath El-Bab et al. 2010 and Nada et al. 2014).** Therefore, the present study was aimed to evaluate the Quality parameter of some shrimp and crab.

## 2. Materials and methods

### 2.1 Collection of samples:

A Total of One Hundred and Twenty samples of Crustaceans, 60 samples of Shrimp (30 of peeled shrimp & 30 of unpeeled shrimp) and 60 samples of local chilled Crab were collected from Beni-Suef markets. The collected samples were identified and directly transferred in an insulated ice box to the laboratory with minimum of delay to be examined within 6 hours from collection.

The pH was determined according to the method recommended by **Korkeala et al. (1986).**

### 2.2 Quality parameters:

Total volatile basic nitrogen TVB-N (mg N/100 g) was measured according to the method recommended by **FAO (1986).**

### 2.3 Bacteriological examination

Preparation of the of collected samples was done according to the muscle maceration technique recommended by **ICMSF (1986)** as follows:

Ten grams of samples was removed using sterile scalpel and forceps and transmitted to a sterile homogenizer flask containing 90 ml of 0.1% sterile peptone water (DM185D, MAST, UK). The contents were homogenized at 2000 rpm for 2.5 minutes using a sterile homogenizer (MPW 302, Universal Laboratory Aid, made in Poland). The homogenate was allowed to stand for about 15 minutes at room temperature. The contents represented the dilution $10^{-1}$ were thoroughly mixed by shaking, one ml was aseptically transferred using a sterile pipette into a sterile test tube containing 9 ml of 0.1 % sterile peptone water to be diluted in a

sequential manner by ten-fold serial dilution up to $10^{-6}$.

Aerobic plate count (APC) at 35 C for Mesophilic count and at 7 C for Psychrophilic count and coliforms MPN (3 tubes method) were performed on lauryl sulphate broth for 24 to48 hours as well as Fecal coliforms on E.C. broth for 24 to48 according to the techniques recommended by **AOAC (1990).**

Samples for *Staphylococcus aureus* were spread plated on a Baird Parker agar and incubated at 35 °C for 48 h. Typical colonies were confirmed using tube coagulase test **(AOAC, 1995).**

## 3. Results

In this study, table (1) showed that the mean values of pH in the examined samples of Unpeeled shrimp, Peeled shrimp and crab were 6.346, 6.590 and 6.62, respectively while the mean value of TVB-N in the examined samples of Unpeeled shrimp, Peeled shrimp and crab were 21.348, 24.787 and23.78 mg/100g respectively. Table (2) revealed that the mean aerobic bacterial counts at 35°C & 7°C of the examined Unpeeled shrimp samples were$10^4$ and $8x10^4$ CFU/g, respectively. In the same table, the mean values of coliforms (MPN), fecal coliform (MPN) and *E. coli* (MPN) for shrimp were 4 x10, 17 and 4 m.os/g , respectively. While The mean values of *S. aureus* count for imported un peeled shrimp was 2 $x10^3$ CFU/g. Table (3) revealed that the mean aerobic bacterial counts at 35°C & 7°C of the examined Local peeled shrimp samples were1 $x10^5$ and $9x10^4$ CFU/g, respectively. In the same table, the mean values of coliforms (MPN), fecal coliform (MPN) and *E. coli* (MPN) for shrimp were 5 $x10^2$, 5 $x10^2$ and 11 m.os/g, respectively. While The mean values of *S. aureus* count for local peeled shrimp was $4x10^3$CFU/g. On other hand Table (4) revealed that the mean value of APC at 35°Cand APC at 7°Cof the examined crab samples were2 $x10^5$and 6 $x10^4$ CFU/g, respectively. In the same table, the mean values of coliforms (MPN), fecal coliform (MPN) and *E. coli* (MPN) for examined crab samples were 3 $x10^2$, 4 $x10^2$ and 4 m.os/g respectively. While The mean values of *S. aureus* count in crab was 2 $x10^3$ CFU/g.

**Table (1): Statistical analysis of the chemical criteria of the examined samples.**

| Crustacean | Number of Samples | criteria | Minimum | Maximum | Mean | S.E. |
|---|---|---|---|---|---|---|
| Crab | 60 | PH | 6.08 | 7.81 | 6.62 | 0.089 |
| | | TVB-N mg% | 18.33 | 29.06 | 23.78 | 0.69 |
| Peeled Shrimp | 30 | PH | 6.220 | 20.340 | 6.590 | 0.04349 |
| | | TVB-N mg% | 6.690 | 28.600 | 24.787 | 0.9517 |
| Unpeeled shrimp | 30 | PH | 6.080 | 14.000 | 6.346 | 0.06804 |
| | | TVB-N mg% | 6.700 | 25.540 | 21.348 | 1.273 |

**Table (2): Statistical analysis of the bacterial count (m.os/g) of the examined Imported unpeeled shrimp samples.**

| Criteria | Minimum | Maximum | Mean | SE |
|---|---|---|---|---|
| Mesophilic count | $10^3$ | $6 \times 10^4$ | $10^4$ | $4 \times 10^3$ |
| Psychrophilic count | $10^3$ | $9 \times 10^5$ | $8 \times 10^4$ | $4 \times 10^4$ |
| Coliforms (MPN) | 3 | 150 | 4 x10 | 10 |
| Fecal coliforms (MPN) | 3 | 93 | 17 | 6. |
| *E. coli* (MPN) | 3 | 23 | 4 | 1 |
| *S. aureus* count | $<10^2$ | $7 \times 10^3$ | $2 \times 10^3$ | $5 \times 10^2$ |
| *S. aureus* count | $<10^2$ | $7 \times 10^4$ | $4 \times 10^3$ | $3 \times 10^3$ |

**Table (3): Statistical analysis of the bacterial count (m.os/g) of the examined crab samples.**

| Criteria | Minimum | Maximum | Mean | SE |
|---|---|---|---|---|
| Mesophilic count | $1 \times 10^3$ | $7 \times 10^5$ | $2 \times 10^5$ | $3 \times 10^4$ |
| Psychrophilic count | $10^2$ | $3 \times 10^5$ | $6 \times 10^4$ | $1 \times 10^4$ |
| Coliforms (MPN) | 3 | $1.1 \times 10^3$ | $3 \times 10^2$ | 65.360 |
| Fecal coliforms (MPN) | 3 | $1.1 \times 10^3$ | $4 \times 10^2$ | 72.866 |
| *E. coli* (MPN) | 3 | 23 | 4 | 0.6804 |
| *S. aureus* count | $<10^2$ | $8 \times 10^3$ | $2 \times 10^3$ | $4 \times 10^2$ |

## 5. DISCUSSION

From table (1) showed that the mean values of pH in the examined samples of Unpeeled shrimp, Peeled shrimp and crab were 6.346, 6.590 and 6.62, respectively, which within the permissible limit (6.5:7) recommended by **FDA (2007)**. The obtained results were nearly similar with **Fath El-Bab et al. ( 2010)**, **Gimenez and Dalgaard (2004)** and **Nada et al. (2014)**.There is a relationship between the increase of pH value and the deterioration of food compounds produced as a result of microbial activity and enzymatic autolysis, could cause the increases in pH, this in accordance with that reported by **Huss et al. (2000)**. the mean value of TVB-N in the examined samples of unpeeled shrimp, Peeled shrimp and crab were 21.348, 24.787 and23.78 mg/100g respectively which were within the permissible limit (30 mg /100 g) recommended by **ES (2005a)**. These results also similar nearly **with Fath El-bab et al. (2010)**, **Kyrana and Lougovois (2002) and Nada et al (2014)**. In this respect, **Montgomery et al. (1970)** reported that the maximum limit of acceptability of TVB content of peeled shrimp in Australia and Japan was 30 mg

/100G.Whereas, **Wibowo et al. (1992)** considered a level of TVB-N of 30 mg/ l00g as a limit of acceptability for industrial purposes. Furthermore, they added that fishy odor started to develop when the TVB-N was 30.44 mg N% and the development of putrefactive odor was accompanied by a value of 31.88 mg N%. On the contrary **Yamagata and Low (1995)** recorded that TVB-N level of 12.11 and l4.48 mg N% were enough to develop such a fishy and distinct ureal odor in shrimp samples, respectively. From previous data it could be concluded that TVB-N content of 30 mg N% is considered a specific limit of acceptability and 80% of the examined iced peeled shrimp in this study are considered acceptable, whereas, 100% of the samples should be considered acceptable according to the specified permissible limit (65 mg N%) given in the **ESS (516/1993)** From the present data, it could be concluded that the TVB-N was a good freshness index for the assessment of shellfish quality due to gradually increase in TVB-N with inclination to spoilage.

Table (2) & (3) stated that that the mean aerobic bacterial counts at 35°C & 7°C of the examined Unpeeled shrimp samples were$10^4$ and $8x10^4$ CFU/g , respectively, while mean aerobic bacterial counts at 35°C & 7°C of the examined Local peeled shrimp samples were1 $x10^5$ and $9x10^4$ CFU/g .on other hand table (4) showed that mean value of APC at 35°Cand APC at 7°Cof the examined crab samples were2 $x10^5$and 6 $x10^4$ CFU/g , respectively, which were within the permissible limit ($10^6$CFU/g ) as recommended by **ESO (2005a).** These results nearly similar with that obtained by **Fath El-bab et al. (2010).** Consequently, the initial bacterial level at arrival to processing plant shall be considered a function of the quality and extent of storage of shrimp or prawn and a limit of up to $10^7$ should be considered a critical limit at the arrival to the processing plant. From the present data, it could be concluded that shellfish are subjected to many risks of contamination from various sources. It is worth mentioned that the chief sources of shellfish contamination are sewage-polluted aquatic environment from which Shellfish were harvested, method of harvest and unsanitary handling practices of Shellfish during harvesting, distribution and marketing. respectively. In the same table, the mean values of coliforms (MPN),fecal coliform (MPN) and *E.coli* (MPN) for shrimp were 4 x10, 17 and 4 m.os/g ,respectively, while in peeled shrimp were 5 $x10^2$, 5 $x10^2$ and 11 m.os/g, respectively, On other hand table (4) showed that the mean values of coliforms (MPN),fecal coliform (MPN) and *E.coli* (MPN) for examined crab samples were 3 $x10^2$, 4 $x10^2$ and 4 m.os/g respectively. The permissible limit ($10^2$ MPN /gm) recommended by **ESO (2005a)** .The contamination of seafood by coliforms lead to clinical symptoms as diarrhea, nausea, vomiting, fever **(Varnam and Evans, 1991).** The mean values of *S. aureus* counts for unpeeled shrimp, peeled shrimp and crab were $4x10^3$, $4x10^3$ and 2 $x10^3$ m.os/g, which was within the permissible limit of (ES 2005 a) which is not more ($10^3$).These results Nearly similar with **Nada et al. (2014), Fath El-Bab et al. (2010)**. Presence of *S. aureus* may be due to contamination of seafood from human sources, equipment during the handling and processing **(Forbes et al., 1998).**

## 6. Recommendation:

Approximately the most difficulties facing the shrimp and Crab are the short shelf life and quality deterioration rather than food poisoning. Therefore, in order to produce good quality crab and shrimp, they must be maintained at good storage chilling condition, protecting them from mishandling, physical damage and other sources of contamination

## 7. References

**Acha RN and Szyfres B (1991).** (Zoonoses and communicable diseases common to man and animals). 2nd[ed], Pan American Health Organization, Washington.

**Al-Dagal MM and WA Bazaraa (1999).** Extension of shelf life of whole and peeled

shrimp with organic acid salts and bifido bacteria. J. Food Prot., 62(1): 51-55.

**AOAC (Association of Official Analytic Chemists), (1990)** Association of Official Analytic Chemists (AOAC)Official methods of analysis 15th USA.

**AOAC (Association of Official Analytic Chemists). (1995).** Official Methods of Analysis, 16th ed., sec. 975.55. AOAC INTERNATIONAL, Arlington, VA.

**Bala'a AMF and LD Marhall (1998).** Organic acid dipping of catfish fillets: effect on color, microbial load and *Listeria monocytogenes*. J. Food Prot., 61(11): 1470-1474.

**Chen HM and S Jiang (1990).** Changes in biochemical and bacteriological quality of grass prawn during transportation by icing and oxygenating. J. Food Sci., 55: 670-673.

**Chen Y. P., Andrews L. S. and GRODNER R. M., (1996).** Sensory and microbial quality of Irradiared crab meat products. J. Fd. Sci., 61: 1239–1242.

**Chung H. Y. and Cadwallader K. R. (1993).** Volatile components in blue crab (Callinectes sapidus) meat and processing by- product. J. Fd. Sci., 58: 1203–1211.

**Cockey RR and T Chai (1991).** Microbiology of Crustacea Processing: Crabs. p. 41−63. Ward DR and Hackney CR (ed.), Microbiology of Marine Food Products, Van Nostrand Reinhold, New york.

**Csavas I (1991).** The impact of aquaculture on the shrimp industry info. Fish Int., 1: 42-48.

**Edema MO, Atayese AO and Idowu AO (2005).** Microbiological quality of Microwave – Processed Foods. In: The Book of Abstract of the 29th Annual Conference and General Meeting on Microbs as agents of sustainable development, organized by Nigerian Society for Microbiology (NSM)., UNAAB, Abeokuta, pp.17.

**Ekholm DF and Hirshfield IN (2001).** "Rapid methods to enumerate Ecoli in foods using 4- Methy – Lumbelliferyl. B- D-Glucuronide, J AOAC Int. 84:407- 415.

**ESO (2005a).** "Egyptian Standards No. 889-1" for whole frozen fish part 1, A.R.E. Egyptian organization and quality.

**E.S.S, 516/1993** Egyptian standards, frozen shrimp. Egyptian Organization for Standardization and Quality Control

**FAO (Food and Agriculture Organization of the United Nations) (1986)** Food and Agriculture Organization of the United Nations (FAO). Food and nutrition paper. Manual of Food Quality Control 14/8 Food Analysis Rome, Italy.

**Fath El-Bab G FA, Hasanain N HM and Hassab Alnaby (2010).** "Quality investigation of some imported sea food in Egyptian markets. J. Egy. Comp. Path and Clin. Path., 23(1):51-63.

**Forbes BA, Sahm DF and Weissfeld AS (1998).** Diagnostic Microbiology 10$^{th}$ED., Mosby inc., 11830 West Line.

**Gecan J. S., Bandler R. and Atkinson, J. C. (1988).** Microanalytical quality of canned crabmeat, sardines and tuna. J. Fd. Product., 51: 979–981

**Gimenez B and Dalgaard P (2004).** Modelling and Predicting the simultaneous growth of *listeria monocytogenes* and spoilage microorganisms in cold-smoked salmon. J. Applied Microbiol., 96:96109.

**Gracey LF,Collins DS and Huey RJ (1999).** "Meat Hygiene "10$^{th}$ Ed., Horcourt Brance and Company.

**Huss H.H., Reilly A. and Embarek P.K.B. (2000).** Prevention and control of hazards in seafood. Food Control 11: 149-156.

**Ingham, S.C., Alford, R.A. and Mccown, A.P. (1990).** Comparative growth rates of Salmonella typhimurium and Pseudomonas fragi on cooked

crab meat stored under air and modified atmosphere. J. Fd. Protect., 53: 566–567.

**International Commission on Microbiological Specifications for Food (ICMSF) (1986).,** Microorganisms in Foods, Sampling for Microbiological Analysis, Principles and Scientific Applications (2nd ed.), vol. 2, University of Toronto Press, Toronto, Buffalo, London

**Jeyasekaran G, Ganesan P, Anandaraj R, Jeya Shakila R and Sukumar (2006).** Quantitive and qualitative study on the bacteriological quality of Indian white shrimp (paenusindicus) stored in dry ice. J. Food Microbiol,23(6):526-33.

**Korkeala O, Petäys M T, Alanko O and Sorvettula O (1986).** Determination of pH in meat. Meat Sci, 18, pp. 121–132.

**Kyrana VR and Lougovois VP (2002).**" Sensory, Chemical, Microbiological assessment of farm raised European sea bass stored in melting ice " J. Int. Food Sc. Technol., 37:319-328.

**Morais CDE (1995).** Effect of citric acid and sodium metabisulfite on iced shrimp quality. Coletanea Do Instiuto De Tecnologia De Alimentos, 25(1): 35-45.

**Nada S M, EL Zahaby D I, Dahshan E M and Ola FA (2014)** "Chemical and Bacteriological evaluation of some sea foods" medical journal, 27,2:1-8.

**Okonko IO, Adejoye OD, Ogun AA, Ogunjobi AA, Nkang AO and Adebago BC (2009).** Hazards analysis critical control points (HACCP) and microbiology qualities of seafoods as affected by handler's hygiene in Ibadan and Lagos, Nigeria African. J. food Science, 3(2):35-50.

**Oranusi SU, Umoh Vj and Kwagaj K P (2003)** Hazard and critical control points of Kunun –Zaki a non alcoholic beverage in Northern Nigeria. Food Microbiol. 20:127-132.

**Özyurt G., Kuley E., Özkütük S. and Özogul F. (2009):** Sensory, microbiological and chemical assessment of the freshness of red mullet (Mullus barbatus) and goldband goatfish (Upeneus moluccensis) during storage in ice. Food Chemistry 114: 505–510.

**Ramachandran A. and ShahulHameed M. (1997).** A comparative study between machine peeled and hand peeled shrimp. FAO fisheries report no.563 Food and Agriculture Organization of the United Nation, Rome.

**Ray B., Webb N.B. and Speck M.L. (1976).** Microbological evaluation of blue crab processing operations. J. Fd. Sci., 41: 398–402.

**Rippen TE, hackney CR and lane RM (1989).** Factors affecting heat transfer and shelf life of pasteurized crabmeat. Interstate Seafood Seminar, Ocean City, MD.

**Senger, P.W. (1992).** Spoilage of pasteurized crabmeat by a nontoxigenic psychrotropic anaerobic spore former. J. Fd. Microbiol., 55: 176–181.

**Speedy AW (2003):** GLOBAL production and consumption of animal source foods. J. of Nutrition 133:4048 – 4053.

**Suklim K., Flick G., Bourne D.W., Granata LA., Eifert J., Williams R., Popham D. and Wittman, R (2008).** Pressure-induced germination and inactivation of Bacillus cereus spores and their survival in fresh blue crab meat (Callinectes sapidus) during storage. Journal of Aquatic Food Technology. 17(3): 322-337.

**Varnam AH and Evans MG (1991) :** Food–borne Pathogeneses. An illustrated text. Woolf Publishing Ltd.

**Vaughn C (2007).** Shore crab pickers threatened. The Daily News. Delmarvanow.com. Salisbury, MD. available at: http:// www.delmarvanow.com/apps/

pbcs.dll/article?aID=/20071105/ NEWS01/711050308/1002. accessed February 2008.

**Ward DR, Piersonand MD and Tassell kRV (1977)** . The microflora of unpasteurized and pasteurized crab meat. J. Food Sci. 42:597–600. Press, Boca Raton, Fl.

**Wents B.A., Duran A.P., Swartzentruber A., Schwab A. H., Mcclure, F.D. and Read, R.B. (1985).** Microbiological quality of crabmeat during processing. J. Fd. Protect., 48: 44–49.

**WHO" World Health Organization" (1999).** Food Safety Issues Associated with products from aquaculture. Report of joint, World Health Organization, Tec. Rep., 883(i-vii):1-55.

**Wibowo, S.; Putro, S.; Suwarno, T.; Sukarto, S. T. and Wardoyo, S(1992):**The pattern of post-mortem biochemical and microbiological changes in farmed tiger shrimp (Penaeus monodon) at ambient temperature.FAO Fish. Rep. No. 470 (Suppl) Pp. 29-39

**Yamagata , M. and Low , L .K. (1995 ):** Banana shrimp ( Penaeus merguiensis ) quality changes during iced and frozen storage . J. Food Sci .,6O 1721 -726.

**Zuberi R and Qadrim RB (1981).** Bacteriological status of fish and shrimp at landing on fish harbor and local retail markets in Karachi (Pakistan). Pak. J. Sci. Ind. Res., 23(5): 196-200.