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Chemical Composition, Physicochemical and Microbiological Quality Properties of *Cyprinus carpio* and *Euthynnus alletteratus*

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ABSTRACT

This research was designed to determine the chemical composition, physicochemical and microbiological quality of fresh common carp (*Cyprinus carpio*) and little tuna (*Euthynnus alletteratus*) fish. The results showed that, values of moisture, protein, lipid, ash, and carbohydrates of fresh common carp and little tune fish samples were as follows: for common carp, 74.45, 17.74, 4.81, 2.11, 0.89% were recorded, while for little tuna, 70.38, 22.07, 6.15, 1.43 and 0.56% were registered, respectively. Whereas, TVB-N, TMA-N, TBA and pH values of fresh common carp and little tuna fish samples were as follows: for common carp, 8.36mg/ 100g, 1.56mg/ 100g, 0.48mg malonadehyde/ kg and 6.15, 46.55; for little tuna, 16.84mg/ 100g, 2.02mg/ 100g, 0.58mg malonadehyde/ kg, 6.35, 47.86, respectively. Referring to microbial quality characteristics, it is well established that spore forming bacterial count, yeast, and mold count, *E. coli* and *Salmonella* were not detected in fish samples, while total plate count and total coliform count of fresh common carp and little tuna fish samples were recorded as 3.15 and 3.07 log cfu/ g for common carp, and as 1.66 and 1.23 log cfu/ g for little tuna, respectively. The microbiological assessment of the fresh fish indicated that they were of high quality and safe for utilization, either as fresh fish or for further processing and use. The present study provided valuable information on the quality and safety of both fresh common carp and little tuna fish which will greatly help in designing the optimum conditions in developing the post-harvest value chain, leading to higher consumer acceptability of this fish species. Moreover, the findings of this study could be used to optimize the post-harvest handling systems of the fish and subsequent processing in order to deliver a wholesome and safe product to the consumer.

INTRODUCTION

Indeed, information on the proximate composition, physicochemical and microbiological properties of fresh fish from is limited. Moreover, due to the changes in climate conditions, season, and industrial growth, there could be wide differences in the biochemical constituents of the fish **(Javaid *et al.*, 1992)**. The chemical composition of

fish varies greatly by species and individual depending on age, sex, environmental conditions and season. Proximate composition involves the determination of moisture, lipid, protein, and ash contents. Common carp (*Cyprinus carpio*) is one of the most important fish species in aquaculture throughout the world. Annual world production is around 3000000 tons, with the European production accounting for 145000 tons **(FAO, 2012)**. Common carp (*C. carpio*) is one of the most cultured fish in the world. However, its consumer preference is low, leading to a limited market presence due to the presence of intramuscular bones. Hence, there is a need to develop some convenience products from the meat of carps to enhance their consumer acceptability **(Vanitha *et al*., 2013)**.

Little tuna *Euthynnus alletteratus* is a pelagic species; it is one of the members of the Scombridae with a wide distribution in the world and is predominant in the Mediterranean Sea and Black Sea **(Valeiras & Abad, 2007)**. It occurs in the Mediterranean throughout the year, with higher abundance during the summer months. The Egyptian Mediterranean catch from *E. alletteratus* fluctuated between 1302 and 1003 tons in the period from 2010 to 2018 **(GAFRD, 2019)**. Some studies were conducted to determine the quality of this fish species. **Fadl (2014)** found that the chemical composition of kapreeta fish flesh did not have remarkable differences in moisture (77.80%), crude protein (76.99 %), ether extract (4.80%), ash (4.46 %) and carbohydrates 13.75%. **Genina (2017)** stated that, moisture content of fresh kapreeta fish decreased from 71.75 to 53.88% in untreated smoked fish fillet, and to 54.50% and 54.74% in treated samples, with 5% thyme or sage essential oils, respectively. The protein, lipid and ash contents of fresh kapreeta fish samples were 24.54, 2.11 and 1.60%, respectively. These values increased after liquid smoking in both untreated and treated smoked fish fillets. **Hizbullah *et al*. (2020)** postulated that, water content, ash content, fat content, protein content, and carbohydrate content of little tuna fish were 73.14, 1.32, 0.08, 22.97 and 2.26%, respectively.

MATERIALS AND METHODS

Materials

Fish samples collection and preparation

Fresh common carp (*Cyprinus carpio*) with 44± 6.11cm total lengths and 4.45± 0.51 kg total weights were obtained from Manzala aquatic farm belonging to GAFAD, Egypt, during December 2019. Moreover, fresh little tuna (*Euthynnus alletteratus*) with 49± 4.01cm total lengths and 6.50± 0.48kg total weights were purchased from Alexandria fish market, Egypt, during December 2019. Fish samples were transported immediately using ice box in three hours to Fish Processing and Technology Laboratory, El-Kanater El-Khairia, Fish Research Station, National Institute of Oceanography and Fisheries. Fish samples were washed well with tap water, beheaded, gutted, filleted after the removal of scales, fins, skin and large bones, then rewashed carefully and drained.

Analytical methods

Moisture, crude protein, lipid and ash were determined according to the guidelines of **AOAC (2012).** Carbohydrates were calculated by the difference in the sum of the values of fat, ash, moisture, and protein content. The pH value was measured as described **Egbert *et al.* (1992)**. Total volatile basic nitrogen (TVB-N) contents were determined according to the guidelines of **AOAC (2012)**. Moreover, trimethylamine nitrogen (TMA-N) contents were determined as mentioned by **Pearson (1976)**, and thiobarbituric acid (TBA) values were determined according to **Siu and Draper (1978)**. Total mesophilic bacterial count (TMBC) and total psychrophilic bacterial count (TPBC) were determined according to the method described in **APHA (2001)**. Fo the total plate count (TPC), *E. coli* and *Salmonella* were determined according to **ISO (2003)** via a nutrient agar medium, as described by **Oxoid (2006)**. Yeast and mold counts (YMC) were determined in accordance with **ISO (2008)**. Data were expressed as the mean values of three replicates, and standard deviations were statistically analyzed by performing the analysis of variance technique (ANOVA), using the statistical analysis system according to **SAS (2008)**. Differences among means were compared using Duncan's multiple range test (1955) at a significant level of 95% ($P \leq 0.05$).

RESULTS AND DISCUSSION

Chemical composition

The chemical composition of fish flesh could be affected by several intrinsic and extrinsic factors. The first factors include age, sex and size which are related to the different ratios of viscera, muscles and bones in fish body. The second factors include the environmental factors, mainly water temperature which regulates the rate of fish growth and food composition which could govern the biochemical composition of fish flesh, especially under cultivation **(Nortvedt & Tuene, 1998)**.

Table 1. Chemical composition of fresh common carp and little tuna fish (on wet weight basis)

Parameter	Common carp	Little tuna
Moisture %	74.45±0.85	70.38±0.73
Protein %	17.74±0.43	22.07±0.56
Fat %	4.81±0.59	6.15±0.84
Ash %	2.11±0.82	1.43±0.78
Carbohydrate %	0.89±0.19	0.56±0.19

Data are the mean ± SD, n = 10; Carbohydrates percent calculated by difference.

The moisture, protein, lipid, ash and carbohydrates of fresh common carp fish were 74.45, 17.74, 4.81, 2.11 and 0.89%, respectively, while they recorded values of 70.38, 22.07, 6.15, 1.43 and 0.5 % for fresh little tuna (*Euthynnus alletteratus*) fish samples,

respectively (Table 1). In general, the chemical composition of fish differs from one to the other depending on environment, season, sex, and age. The chemical composition of fresh fish is given as 66– 81% water, 16– 21% protein, 0.2– 15% fat, 1.2– 1.5% mineral and 0– 0.5% carbohydrate **(Mazumder *et al*., 2008)**. The obtained results coincide with those of **Muraleedharan *et al*. (1996)**, **Murthy *et al*. (2019)** and **Badran *et al*. (2020)**.

Physicochemical quality

The pH values are an important factor and can be used as a good indicator for evaluation freshness and quality of fish. Moreover, values of thiobarbituric acid reactive substances (TBARS) is considered as an indicator for the amount of malonaldhyde (MDA), which is the most predominant secondary oxidation products of lipid food **(Greene & Cumuze, 1982)**. In addition, the TVB-N content is an indicative of putrefaction and decompositions of proteins constituent's breakdown in fish tissues **(Khallaf, 1990)**.

Table 2. Physicochemical quality of fresh common carp and little tuna fish

Parameter	Common carp	Little tuna
TVB–N (mg/100g sample)	8.36±0.96	16. 84±0.89
TMA-N(mg/100g sample)	1.56±0.33	2.02±0.57
TBA (mg malonadehyde/kg)	0.48±0.82	0.58±0.47
pH value	6.15±0.94	6.35±0.66
Water holding capacity %	46.55±0.77	47.86±0.98

Data are the mean ± SD, n = 10.

Table (2) shows that the TVB-N, TMA-N, TBA, pH value and WHC of fresh common carp were 8.36mg/ 100g, 1.56mg/ 100g, 0.48mg malonadehyde/ kg, 6.15 and 46.55%, respectively. On the other hand, for fresh little tuna, values recorded were16.84mg/ 100g, 2.02mg/ 100g, 0.58mg malonadehyde/ kg, 6.35 and 47.86%, respectively. These results agree with those of **Živković *et al.* (2004)**, **Khidhir (2011)**, **Ćirković *et al.* (2012)** and **Khanipour *et al.* (2014)**. These obtained results indicate that tested fresh fish samples were within national and international standards and did not exceed the maximum permissible limits of TVB-N and TMA-N and TBA. **Connell (1995)** reported that the limit of acceptability of fish is 20 to 30mg N/ 100g. On the other hand, **Kirk and Sawyer (1991)** suggested values of 30 to 40mg N/ 100g as the upper limit. **Ghaly *et al.* (2010)** also suggested that a level below 25mg/ 100mg serves as the borderline for the TVB-N content for various fish and fish products. From the data presented in Table (2), the pH value was 6.35 for fresh little tuna, and 6.15 for fresh common carp fish. This result is in accordance with those of **Genina (2017)** who found that, the pH of fresh kapreeta (like tuna) fish flesh was 6.4. The WHC mean values in little tuna and common carp fish was 47.86 and 46.55%, respectively. Whereas, water holding ability was inversely proportional with the percentage of calculated WHC according to free water lost upon the

determination. The variation in % WHC could be also discussed based on the fat content of fish species.

Microbiological quality

The quality of fish could be degraded through a complex process, in which the physical, chemical, and microbiological forms of deterioration are involved. The enzymatic and chemical reactions are usually responsible for the initial loss of freshness, whereas microbial activity is responsible for the obvious spoilage, and thereby establishes product shelf- life **(Huss, 1997)**.

Table 3. Microbiological quality of fresh common carp and little tuna fish

Parameter	Common carp	Little tuna
Total plate count (log cfu/g)	3.15	3.07
Total coliform count (log cfu/g)	1.66	1.23
Spore forming bacterial count (log cfu/g)	≤1	≤1
Yeast and mold count (log cfu/g)	≤1	≤1
E. coli (log cfu/g)	ND	ND
Salmonella (log cfu/g)	ND	ND

ND: Not Detected.

Table (3) shows that the total plate count (log cfu/g) and total coliform count (log cfu/g) of fresh common carp and little tuna were as follows: for common carp, values were 3.15 and 3.07, while for little tuna, values were 1.66 and 1.23, respectively, while spore forming bacterial count (log cfu/ g), yeast, and mold count (log cfu/ g) were evaluated. Remarkably, *E. coli* (log cfu/ g) and *Salmonella* (log cfu/g) were not detected in any of the fish samples. This results agree with the findings of **Talab *et al*. (2014)**. The microbiological assessment of the fresh fish indicates that they were of a high quality and safe for utilization, either as fresh fish or for further processing and usage.

CONCLUSION

The present study provides valuable information on proximate composition, physichochemical and microbiological quality of both fresh common carp and little tuna fish, which will greatly help in designing the optimum conditions for developing the post-harvest value chain, leading to higher consumer acceptability of this fish species.

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