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Some Biochemical Parameters (vitamin and mineral content)

In Carp (*Cyprinus Carpio*) Fished From Fresh Water In Dam Of Mascara, Algeria

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Abstract

We conducted this investigation by assessing a few biochemical characteristics of the flesh of freshwater fish, specifically the common carp (*Cyprinus carpio*) that was captured in Mascara. In addition to the qualitative and quantitative richness in minerals, specifically potassium (K=41,24), calcium (Ca=28,51), phosphorus (P=15,55), and iodine (I=9,98), the biochemical studies we conducted reveal a richness in vitamins: vitamin E = 0,804 and vitamin C = 0,241. These immediate findings highlight the high vitamin and mineral content of common carp flesh, which ought to increase public knowledge and motivate local and national residents to appreciate and eat this fish as a dietary and nutritious food.

Key words: biochemical parameters, *Cyprinus carpio*, Mascara, vitamins, minerals.

I. Introduction

A biochemical analysis of the flesh of the common carp (*Cyprinus carpio*), a freshwater fish captured in Mascara, was of interest to us in this work. Algeria has concentrated its efforts in recent years on creating a national aquaculture development strategy that is sustainable. According to the mindset and eating habits of the local and national population, our nation's substantial natural water resources are not being fully and effectively utilized. One example of this is the Ouizert dam, where our species of fish is highly abundant but underutilized. We wish to increase awareness of this freshwater fish's vital dietary and nutritional benefits to a healthy lifestyle.

II. Materials and methods

Thirty-two specimens of *Cyprinus carpio* were caught from the Ouizert dam early in the morning. The samples were taken from the Ouizert dam during the year 2021. Most specimens of the common carp *Cyprinus carpio* were caught using a net and some using a fishing rod; Specimens of the common carp *C. carpio* are transported to the laboratory carp *Cyprinus carpio*; it is a large, fusiform cyprin with a thick, elongated, stocky and laterally flattened body, covered with large cycloid scales. of our faculty and kept at a temperature of 4 - 5 °C.

II.1. Determination of water-soluble vitamin content (Vit C)

We carried out the biological identification of determining the content of water-soluble vitamins, iodometric determination of ascorbic acid (vitamin C). The principle of titration is based on determining the concentration of a solution by gradually adding to a given volume of that solution, which reacts with the solution whose concentration is to be determined. The same principle applies to the iodometric determination of ascorbic acid, which consists of determining the iodine present in the medium using a sodium thiosulphate solution. The quantity of ascorbic acid contained in a vitamin C- rich sample is determined using an indirect assay in which ascorbic acid is oxidized to dehydro- ascorbic acid using iodine. After this first reaction, the excess iodine that did not react with the sodium thiosulphate is measured (Daumorie, 1999)

The quantity of ascorbic acid in the initial solution is then determined by difference. The calculation of the number of moles of excess triiodide ions is given by the following relationship

$$N \text{ excess triiodide ions} = C_2 \cdot V_2 / 2$$

The number of moles of ascorbic acid present in the ascorbic acid solution analyzed is:

$$N \text{ ascorbic acid} = n \text{ triiodide ions introduced} - n \text{ triiodide ions in excess}$$

The concentration of ascorbic acid in the sample analyzed is calculated according to the following equation:

$$C \text{ (ascorbic acid mol/L)} = n \text{ (ascorbic acid mol /V) ascorbic acid analyzed}$$

A calibration curve is established for the iodometric determination of ascorbic acid in order to compare the theoretical and experimental concentrations. To do this, different dilutions are made from the ascorbic acid stock solution for concentrations ranging from 0.05mM to 0.6mM. The final volume is 5ml (Sari, 2017).

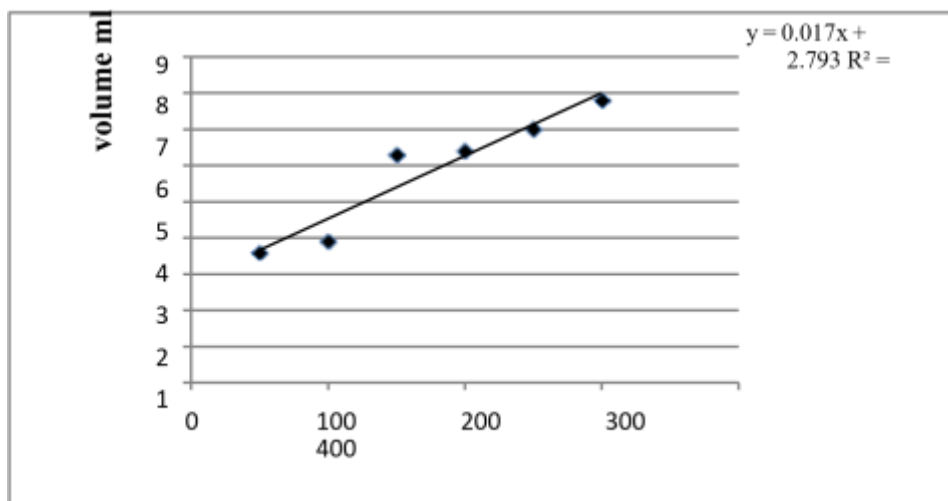


Figure 01: Calibration curve for ascorbic acid (Titrimetry).

○ Results for Vit C:

$$\text{Vit C\%} = \frac{C \cdot 5 \cdot V}{m \cdot 10^4}$$

C: Concentration read off the graph.

5: Number of dilutions.

V: Volume of extraction solution

m: Mass of test sample.

10⁴: Conversion factor for vitamin C content from ppm to % fresh matter.

II.2. Dosage of fat-soluble vitamins (Vit E)

The determination of fat-soluble vitamins or the determination of tocopherol E by the colorimetric method: Brown ferricyanide in alcohol-chloroformic solution is rapidly and quantitatively reduced by tocopherols (vitamin E activity factor) to give a uniform blue color of ferrous ferricyanide: the reaction is complete in 15 seconds (Lecoq, 1965).

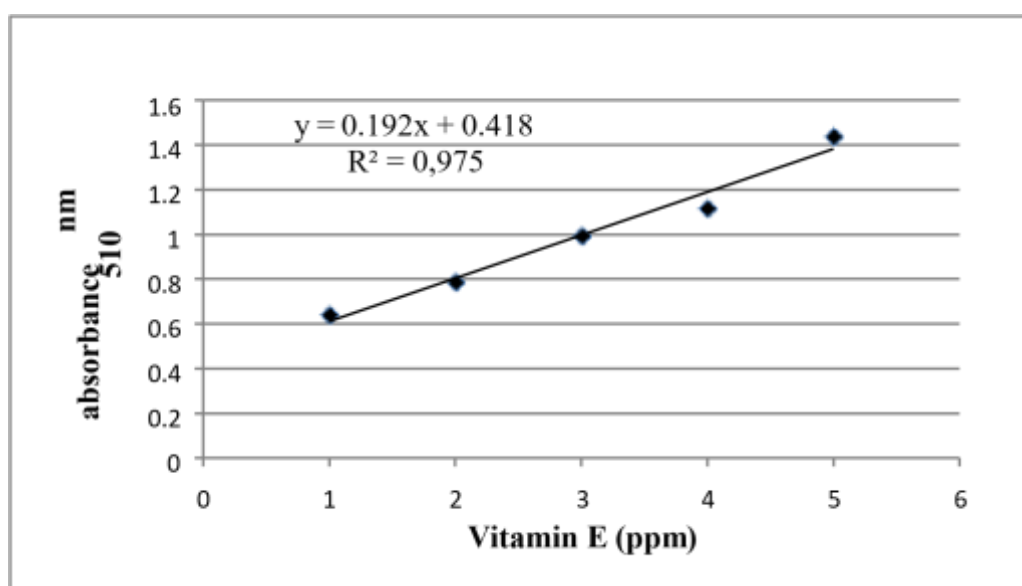


Figure 02: Calibration curve for tocopherol (Deymié, 1974; Bourgeois, 2003).

□ Results for Vit E :

$$\text{Vit \%} = \text{C5V} / \text{M} \cdot 10^4$$

C: Concentration read off the graph.**5:** Number of dilutions.**V:** Volume of extraction solution **M:**

Mass of the test socket.

10⁴: Conversion factor of tocopherol or retinol content from ppm to % fresh matter (Deymié, 1974; Bourgeois, 2003).

II.3. Determination of minerals using micro-ray fluorescence (μ XRF)

Determination of minerals by X-ray microfluorescence (μ XRF) which uses X-rays (in rhodium) as the excitation source, but is unable to measure certain light elements due to the low value of their effective ionisation cross-section. It is therefore impossible to measure elements ranging from hydrogen ($Z=1$) to sodium ($Z=14$) (Rindby *et al.*, 1967).

For this type of dosage, the sample must be designed in a pellet, the latter requires a binding additive (KBr salt, wax, etc.) or even boric acid as in our case, finely ground and dehydrated in which approximately 1% of the sample to be analyzed is mixed. Then using a pellet mold and a press, the powder is subjected to a pressure of approximately 25 tons for a few seconds, under the effect of the pressure we obtain a homogeneous and translucent pellet of 13mm in diameter and 2-3 mm thick which can be analyzed directly. **II.4. Statistical analysis**
The ANOVA analysis was carried out given the number of batches and a *Student's* t-test was applied; $P \leq 0.05$ is considered significant for information purposes; the significance of the results for each section is indicated in the results for that section.

All statistical analysis and graphical presentation in this study was carried out using GRAPH PAD PRISM version 7 software.

III.Results and discussion III.1.Résultats of Vitamin C content The results of the vitamin C content of the carp samples are illustrated in the following figure:

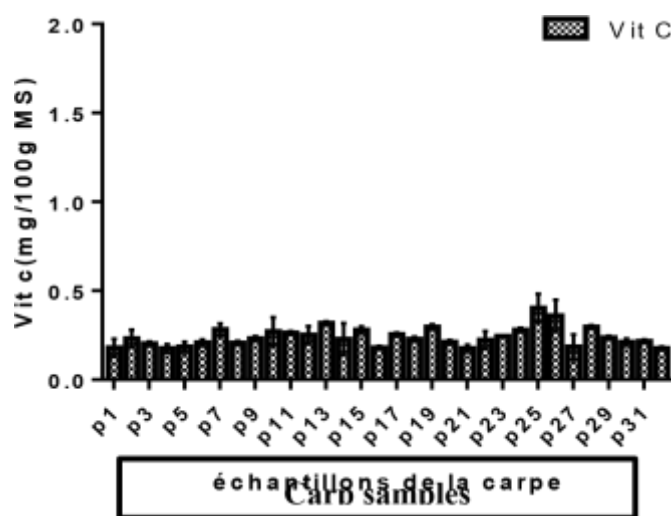


Figure N°03: Vitamin C content of samples from *Cyprinus carpio*

Figure 3 below displays the vitamin C content of the carp samples. We can see that *Cyprinus carpio* has a vitamin C content of 0.3 mg/100g, but our sample has less ascorbic acid than those studied by Lall and Parazo (1995) and Ozyurt et al. (2009), which had contents of 1 and 1.140 mg/100gMS, respectively.

Fish flesh is generally low in vitamin C (1 to 5 mg/100 g). As fish are unable to synthesize it, they draw it from their diet, so the water-soluble vitamin content in fish flesh increases with dietary intake until it reaches a plateau corresponding to saturation of storage capacity by muscle tissue (Medale *et al.*, 2008).

The results are significant ($p=0.01$); the average vitamin C content is 0.24 ± 0.042 mg/100g DM, this result is in perfect agreement with that found by (Gordon and Martin, 1982).

III.2.Resultats of Vitamin E content

The results of the vitamin E content of the carp samples are illustrated in the following figure:

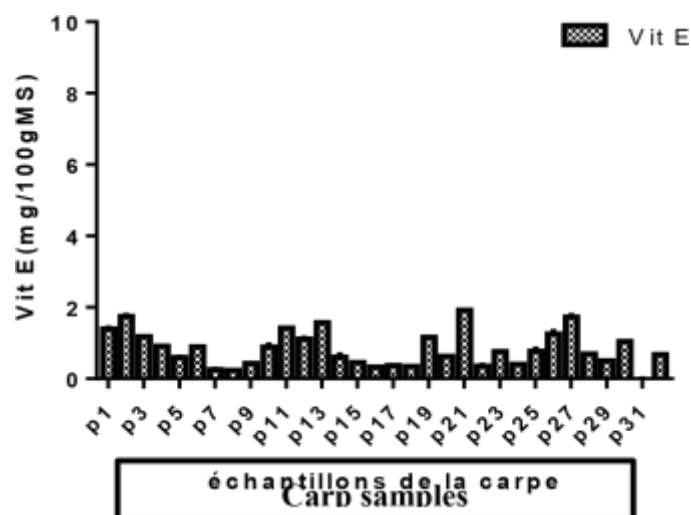


Figure 04: Vitamin E content in the flesh of *Cyprinus* samples

The fat-soluble vitamin (vitamin E) assay results for the carp samples in Figure N°04 are not significant ($p > 0.05$). The average vitamin E content was 0.83 ± 0.39 mg/100g dry matter, which is a relatively high amount when compared to the 0.46 ± 0.010 mg/100gMS found by Ozyurt et al. (2009) on a *Cyprinus carpio* specimen from Turkey. Vitamin E levels in freshwater fish range from 0.2 to 270 mg, more in line with the nutritional table of Ciquel (Sikorski et al., 1989). According to 2021, the common carp (*Cyprinus carpio*) has 0.63 mg of vitamin E per 100g of meat.

In general, fat-soluble vitamins (such as vit E) in fish flesh are affected by the fat content, so this low level of vit E may be due to the low fat content in the muscle tissue (part studied) (Ozyurt, *et al.*, 2009).

Vitamin E has received particular attention for its antioxidant properties. A number of studies conducted on different species of fish have demonstrated the effectiveness of tocopherols, and in particular α -tocopherol, in preventing lipid peroxidation by radical chain reactions and thus reducing the formation of compounds resulting from these reactions (Frigg *et al.*, 1990; Chaiyapechara *et al.*, 2003).

III.3. Results of minerals content

Concerning the assay of minerals, the average levels of minerals in the various samples of common carp are summarized and illustrated in **Figure No. 05**:

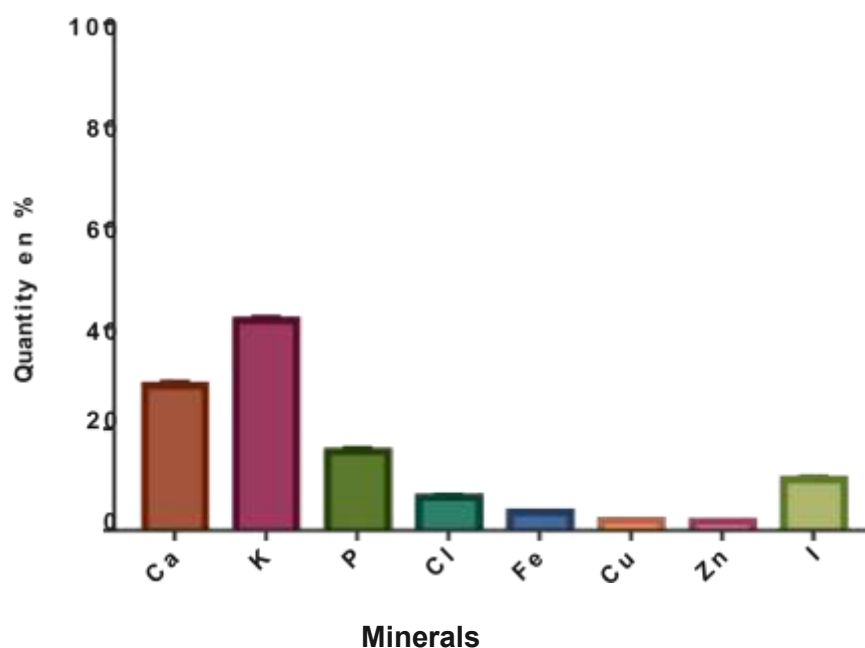


Figure N°05: Average mineral content (Ca; K; P; Cl; Fe; Cu; Zn; I) of common carp (*C. carpio*) from the Ouizert dam in the laboratory

Ca: calcium/K: potassium/P: phosphorus/Cl: chloride/Fe: iron/Cu: copper/Zn: zinc/I: iodine

This histogram shows that our samples have the highest potassium (K) levels, with an average of $41.428 \pm 7.901\%$. However, this is not the case when compared to previous work, as the value is much

lower than those found in various *Cyprinus carpio* specimens by Ozyurt et al. (2009), Otitologbon et al. (1997), and Tkaczewska et al. (2019), which were 358.10 ± 9.68 mg/100g, 320 mg/100gMS, and 154.1 ± 4.0 mg/100gMS, respectively.

Second, our average calcium content is $28.519 \pm 7.529\%$, which is significantly less than the value of 1534 ± 136.3 mg/100g found by Tkaczewska et al., 2019 on a frozen specimen of carp from Poland. This low value can be explained by the fact that 99% of the calcium is found in the skeleton rather than the flesh (part studied) Medale and associates, 2008.

Next we find phosphorus with an average content of $15.551 \pm 1.714\%$, our samples are less rich in this mineral profile than the *Cyprinus carpio* sample from Poland which recorded a content of 2718.1 mg/100g (Tkaczewska et al., 2019).

As for the amount of iron in our sample, the average content is $3.511 \pm 0.915\%$, our results are higher than those found by (Aoudia, 2013) on the bogue species (*Boops boops* L, 1758) with an average of 0.015%. The iron content of fish flesh generally depends on the concentration in the water. The differences between species seem to be partly related to the proportion of red muscle, which is better vascularised and contains more iron than white muscle (Medale et al., 2008).

These results also show that the average iodine content is $9.98 \pm 1.28\%$, half that found in fillets of common carp (*Cyprinus carpio*) from East Africa, which contains 18.7% (Eckhoff and Maage, 1979). Iodine is an important trace element in human nutrition, as it is essential for the synthesis of thyroid hormones (Nerhus et al., 2018).

While the average chlorine content found is 6.555 ± 2.541 in the flesh of the common carp *Cyprinus carpio*, this trace element, even in minute quantities, is an important factor in balancing the quantities of water inside and outside the cells.

It is involved in regulating blood pH (acidity level). In the stomach, it is used to make hydrochloric acid, a constituent of gastric juice (Cardenas, 2017).

According to the results obtained, the copper content of $1.926 \pm 0.256\%$ is higher than those observed by (Turkemen et al., 2005) and (Ozyurt et al., 2009) with 0.08 ± 0.004 and 0.004 mg/100g DM in *Cyprinus carpio* species, bearing in mind that this element is essential for fish metabolism. Fish from unpolluted water (food) (El Morhit et al., 2012) absorb it.

The smallest value detected in this assay is that of zinc, with an average of $1.742 \pm 0.341\%$, which is in perfect agreement with the Turkish specimen studied by (Ozyurt *et al.*, 2009), where they found 1.25 0.12mg/100g, and higher than that recorded by (Lall , 1995).

The ANOVA test showed that all the results were significant ($P < 0.01$) and that the relationship between the minerals was inversely proportional. These intra- and inter-group variations in mineral profile were affected by environmental factors, fat content and water salinity and temperature (Liu *et al.*, 2017).

Other compounds likely to play a part in the biochemical composition of common carp include the vitamin content of fish flesh, which varies greatly depending on the species, the season and the geographical area of habitat. As for lipids, the main factor of variation is dietary intake. However, the flesh of marine fish contains more minerals than that of freshwater fish due to the richness of the marine environment in mineral compounds, which explains the low levels recorded when vitamin E and C were measured (Kendra *et al.*, 2020).

Contrary to its reputation, fish does not generally provide more sodium than meat, or even none at all, as in the case of our sample. This is because fish living in seawater have to absorb large quantities of water to compensate for the difference in osmotic pressure between their hypotonic internal environment and the salt-rich aquatic environment. The contribution of microelements through water is therefore greater than in freshwater (Medale *et al.*, 2008).

It is known that vitamin and mineral concentrations in aquatic organisms are influenced by several factors such as seasonal and biological differences (species, size, age, sex and maturity), food source, environment (water chemistry, salinity, temperature and contaminants), and food processing (Saulum, 2011).

The potential health benefits of fish for human consumption are the presence of high levels of protein, polyunsaturated fatty acids and composition and vitamins and minerals. In conclusion, the results of this study can be used in studies on human nutrition and food composition.

Conclusion

Aquaculture production of the common carp *Cyprinus carpio* continues to grow both worldwide and in Algeria, and this species, like most fish farming products, is poorly valued. Assessing the quality of aquaculture products is therefore crucial to highlighting their nutritional quality and guaranteeing the sustainability and development of such products in the sector.

To increase the proportion of aquaculture products in the diet of Algerians, particularly those residing in the wilaya of Mascara, the study's objective was to conduct a biochemical evaluation of some biochemical parameters of the flesh of freshwater fish, specifically the common carp *Cyprinus carpio* caught in Mascara. This was done in order to highlight the value of this abundant local aquaculture resource and the importance of its consumption, which plays a role in creating healthy, balanced, and diversified eating habits.

From our results relating to the chemical composition of the flesh of this freshwater fish studied, we observed that the common carp *Cyprinus carpi* is of good nutritional and dietetic quality. Their vitamin and mineral profiles are interesting, giving this type of fish the characteristic of a complete food. However, these profiles are very variable quantitatively depending on the biology of this species, the fishing season and the geographical area of habitat, with the major factor of variation being food intake.

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