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Proximate Composition and Micronutrient Contents of *Callianassa turnerana* from the Wouri Estuary, Cameroon

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Abstract

Callianassa turnerana, called Cameroon ghost shrimps is shrimp with a great sociocultural interest in Cameroon. This study assessed proximate composition and micronutrients contents of *Callianassa turnerana* from the Wouri estuary in Cameroon. Adult shrimps were collected. The proximate composition, mineral, carotenoids and vitamin E contents were determined in edible parts (male and female) and in eggs of *C. turnerana* using official analytical methods. One way ANOVA and Fisher’s post hoc PLS test was used to analyze the data. The moisture content were 66±1.5%, 62 ±2.85%, 49.0 ±1.60% in edible parts of male, female and in eggs respectively. Protein contents were high in all the samples ranging from 10.49±0.92% in male edible parts to 30.06±0.89% in eggs. Lipid contents were more than 12% in all samples. Carbohydrate were absent in eggs while the contents were 9.92±0.99% in male and 12.23±0.81% in female edible parts. *C. turnerana* is a good source of minerals. Sodium (0.983±0.001%- 1.656±0.005%) and Phosphorus (0.974±0.002%-1.321±0.002%) were the main macro elements in all samples. Zn was the major microelement in edible parts with the value ranged from 6.43±0.49mg/100g (male) to 7.62±0.35mg/100g (female) while Cu was the major microelement (10.15±3.57mg/100g) in eggs. High levels of total carotenoids (7.9-15.45µg/g) and vitamin E (12.53-24.03µg/g) were recorded. The main carotenoids were β-caroten (0.637-1.337µg/g) followed by α-caroten (0.216-0.437µg/g). *C. turnerana* is a good source of many major nutrients and micronutrients and could be used to combat malnutrition and improve health.

Keywords: *Callianassa turnerana*, proximate composition, micronutrients, Wouri estuary, Cameroon

1. Introduction

Shellfish is worldwide known for its nutritional and economic interest. As the most consumed shellfish, shrimps hold an important place in fishing activities (Food and Agricultural Organisation [FAO], 2016). The increasing demand in shrimps is justified by their nutritional values and their shells. In fact, they are rich in proteins, carotenoids (astaxanthin), polyunsaturated fatty acids ω3 and ω6, minerals, chitin, low in lipids, calories and saturated fat (Ravichandran, Rameshkumar & Rosario, 2009; Maniadis-Meimaroglou & Sinanoglou, 2012). Because of theirs high nutritional value and properties, shrimps are used as food for human an animal, as neutraceutic in pharmaceutical and cosmetics industries. They provide proteins of high biological quality and essential amino acids (Yanar & Celik, 2006; Sriket et al., 2007). In Cameroon, *C. turnerana* commonly called ghost shrimp and localy “mbéatoé or mbotoré” is collected in the littoral region, and especially in the Wouri river estuary where a swarming happens once a year during heavy rainfall (July and August) within 2 or 3 days only. This shrimp is very special to Cameroon as from it, comes the name of the country. Portuguese, in the 15th century discovered the Cameroon River. They arrived at the time when *C. turnerana* was swarming. Greatly impressed by this phenomenon, they named the river "Rio dos camaraos" which mean Shrimps River. The English translated this to "Cameroon River", and the name Cameroon was used for the country and also adopted in other languages (Cameroun in French, Kamerun in Germany…) (Holthuis, 1991). The swarming of *C. turnerana* is the sign for the native population for large scale fishing activities. Local populations enjoy eating *C. turnerana*. They consumed it fresh or smoked. They are also used it as treatment of many diseases. In Cameroon, some biological studies have been reported on this shrimp (Holthuis, 1991); however, no data are available regarding chemical composition of *C. turnerana*. This nutritional study is the first on this shrimp specie in Cameroon. The objective of this study was to evaluate the nutritional composition of *C. turnerana* of the Wouri estuary in Cameroon. Specifically, it aims at determining proximate composition, carotenoids profile, mineral and vitamin E contents.

2. Materials and Methods

2.1 Biological Material Collection

Callianassa turnerana was obtained early in the morning from the artisanal fishermen at the Wouri river estuary in august 2017. Shrimp were introduced in an icebox under cooled conditions and transported to the Laboratory of Foods Sciences and Nutrition at the Faculty of Sciences of the University of Douala. Collected samples were screened, washed with deionized water to remove all adhering contaminations. The length of the shrimp was measured using an ichtiometer and their weight was obtained using a scale.

2.1 Sample Preparation

Males were separated from females. Eggs in the female's body forming an orange stripe running from cephalothorax to the first two abdominal segments were carefully removed. Edible parts made up of flesh, abdominal adipose tissue, exoskeleton hypocalcified of males and females were obtained after removal of their crowbars as well as heads which would contain a throat irritant substance.

2.3 Proximate Analysis

Moisture content was determined using the hot air oven, by drying the sample at 105 ℃ ± 2 ℃ until a constant weight was obtained (Association of Official Analytical Chemists [AOAC], 2005). Total lipids were determined by Bligh and Dyer method using chloroform/methanol (1/1, v/v) (Bligh & Dyer, 1959). Crude protein contents were evaluated by Kjeldahl's method (Nx6.25) (AOAC, 1984; Anderson & Ingram, 1993; Buondonno, Rashad, & Coppola, 1995); Ashes contents were determined after combustion for 20h at 550 ℃ (AOAC, 2005). Total carbohydrate contents were determined by subtracting the sum of fat, proteins, ash and moisture contents from 100g of shrimp (Onyeike, Ayoologu, & Ibegbulam, 2000). All analysis were carried out in triplicate.

2.4 Mineral Analysis

Minerals Ca, Na, K, P, and Mg, as macroelements and Fe, Cu, Mn, Zn as trace minerals were determined in the edible parts and eggs of the shrimps after ashing. Prior to these analysis, ash was weighted, mineralized into nitric acid (HNO_3), $HClO_4$ and deionised water (Pauwels et al., 1992). Mineral contents of the solubilised samples were determined by flame atomic absorption spectrophotometry, using a BUCK Scientific 200A apparatus for Ca, Na, K, Mg, Fe, Zn, Cu, Mn (Benton & Case, 1990; Anderson & Ingram, 1993). Phosphorus was analyzed by colorimetry method using a UV spectrophotometer (Murphy & Riley, 1962).

2.5 Total Carotenoïd Content

Total carotenoids contents were determined by the method described by Simpson, Tisou & Chichester, 1987. Three grams (3g) of fresh shrimps were pounded and introduced in 10ml of hexan/ethanol (1/1; v/v). The whole mixture was shacked strongly and kept in darkness for 15 hours at 4 ℃. Total carotenoids were determined by a photometer (ichek^{TM}Carotene ; BioAnalyt GmbH, Teltow, Germany).

2.6. Determination of Carotenoids Profile and Vitamin E

2.6.1 Sample Preparation

About 0.5 g of crushed sample was introduced in a polypropylene tube. One milliliter of distilled water was then added to the tube. The mixture was shacked and allowed to stand for 30 min. Carotenoids and vitamin E extraction was carried out in a mixture of hexane-isopropanol (3: 2, v / v) under stirring (15 min) using a programmable Rotator Mixer RM-Multi 1. The mixture was then subjected to centrifugation at 3800 tr/min for 5 min using a Thermo Scientific Heraeus Labofuge 200 centrifuge. This operation was repeated twice. After centrifugation, sodium chloride (0.1 M) (5 ml) was added to the supernatant. The solution was stirred and allowed to stand for 30 min. 7.5 ml of hexane containing 0.005% BHT was then added; the mixture shacked and the supernatant collected in a new tube. This last operation was repeated in 5 ml of hexane containing 0.005% BHT. The supernatants were collected and the volume adjusted to 20 ml with hexane. 200 µl of supernatant was transferred in a clean polyethylene tube. The solution was then concentrated in a Techne sample concentrator, SBHCONC/1 under nitrogen (10-15 min). The residue was dissolved in 200 µl of isopropanol and ultrasonicated for 5 minutes. The liquid was then centrifuged at 5000 rpm for 5 minutes. The supernatant was placed in HPLC vial and ready to be injected into the column.

2.6.2 Instrumentation

The chromatography was carried out using a Shimadzu system (Columbia, MD) composed of CBM-20A System Controller, two LC-10ADvp pumps, SIL 10ADvp Auto sampler injector, CTO-10ASvp column oven, and SPD-20A photodiode array detection system set in a range of 100 - 500 nm (all from Waters, Milford, MA, USA). Vitamin E and carotenoids were separated on a reversed C18 column (250 × 3 mm I.D.; particle size, 5 mm) from Merck KGaA (Darmstadt, Germany). The chromatography was carried out using a step gradient elution mode in which eluent A was a mixture of Methanol- Ammonium acetate (water solution) (90: 10 v/v) and eluent B, the mixture of Methanol-Ammonium acetate-terButhyl methyl ether (8: 2: 90, v/v/v) at a flow-rate of 0.2 ml/min.

2.6.3 Quantification

Peaks were identified by their retention time and absorption spectra were compared to those of known standards (Sigma Chemicals). Carotenoids and vitamin E were quantified using peak areas of the authentic standard.

2.7 Statistical Analysis

All results are expressed as the mean of three measurements. Data were presented as mean ± standard deviation. One way ANOVA was performed to test the differences in nutrient contents between the different parts of shrimp. Fisher's post hoc PLSD test was used as classification test. Significance was established at $P < 0.05$. Statistical analyses were done using SPSS 16.0 for windows (SPSS, Chicago, IL, USA).

3. Results

The average weight and length of *Callianassa turnerana* were 41.5±6.513g and 22.5±1.007cm respectively for males. The values recorded for the females shrimp were 29.0±6.131g for weight and 19.5±1.691cm for length. Eggs stand for 15.84±3.74% of the female's edible part.

3.1 Proximal Composition

Table 1 shows the proximal composition of the edible parts of males, females and eggs of *C. Turnerana*.

Table 1. Proximal composition of the edible part of male, female and eggs of *C. Turnerana*

	Male	Female	Eggs
Moisture (%)	66±1.50 ^{a}	62±2.85 ^{b}	49±1.60 ^{c}
Lipids (%)	13.02±0.55^{a}	12.33±0.14^{a}	20.36±2.82^{b}
Proteins (%)	10.49±0.92^{a}	12.88±1.4 ^{b}	30.06±0.89^{c}
Ash (%)	0.57±0.07^{a}	0.55±0.10^{b}	0.58±0.30^{a}
Carbohydrates (%)	9.92±0.99^{a}	12.23±0.81^{b}	0.00

Values are means ± standard deviation for three analyses. In the same line, values with different letters are significantly different at $p<0.05$.

As shown in table 1, chemical composition (moisture, lipids, proteins, carbohydrates and ashes) of the shrimp varied with sex and tissue (edible part or eggs). The water contents were lower than 70% and were significantly different between the edible parts of male, female and eggs ($p<0.05$). The male edible part has the highest value (66%) and eggs the lowest (49%). Ash (0.58±0.3%), protein (30.06±0.89%), and lipids (20.36±2.82%) contents were significantly ($p<0.05$) higher in eggs than in the edible parts of male (0.57±0.07%, 10.49±0.92%, 13.02±0.55% respectively) and female (0.55±0.1%,12.88±1.4%,12.33±0.14% respectively). Ash contents were less than 1% in all samples. A significant difference was only observed between protein and carbohydrate values of female and male edible parts. Elsewhere, carbohydrate were absent in eggs but found with high contents in edible part of males and females.

3.2 Mineral contents

Mineral composition (P, Na, K, Ca, Mg, Zn, Cu, Fe, Mn) of eggs and edible part (males and females) of *C. turnerana* are given in table 2.

Table 2. Macro and microelements contents in the edible parts of male, female and eggs of *C. turnerana*

Mineral	Male	Female	eggs
Ca (%)	0.131±0.002[a]	0.111±0.00 [b]	0.422±0.003 [c]
Mg (%)	0.205±0.00 [a]	0.198±0.004 [a] 0.291±0.00 [a]	0.17±0.003 [b]
K (%)	0.291±0.00 [a]	0.968±0.001[a]	0,470±0.001[b]
P (%)	0.974±0.002 [a]	0.984±0.00 [a]	1.321±0.002[b]
Na (%)	0.983±0.001[a]	3.38±0.00	1.656±0.005 [b]
Na/K ratio	3.37±0.007	0.115±0.00	3.54±0.03
Ca/P ratio	0.135±0.001	7.62±0.35[b]	0.32±0.002
Zn (mg/100g)	6.43±0.49[a]	4.05±1.12[a]	3.62±1.03[c]
Cu (mg/100g)	3.36±0.35[a]	0.63±0.21[b]	10.15 ± 3.57[b]
Mn (mg/100g)	0.53±0.02[a]	6.51±2.75[b]	0.92±0.07[c]
Fe (mg/100g)	7.60±0.49[a]		6.29±2.96[b]

Values are means ± standard deviation for tow analyses. In the same line, values with different letters are significantly different at $p<0.05$.

Sodium and phosphorus were the most abundant macroelements *C. turnerana*. These minerals were significantly higher in eggs than in edible part (male or female). Eggs has significant highest value in Ca (0.422±0.003g/100g), K (0.470±0.001g/100g), Cu (10.15±3.57mg/100g) and Mn (0.92±0.07mg/100g). Edible part stands with a significant highest value in iron (7.6±0.49mg/100g) in male and zinc (7.62±0.35mg/100g) in female. Male edible part has significant higher value in calcium than female part which has the highest value in magnesium in comparison. Ca/P ratio were less than 1in all samples while Na/K is about 3.50.

3.3 Contents of Total Carotenoids, Vitamin E and Carotenoids Profile

Total contents of carotenoids, vitamin E and carotenoids profiles of *C. turnerana* are shown in table 3.

Table 3. Contents of total carotenoids, vitamin E and carotenoids profiles of *C. turnerana* (µg/g)

Samples	total Carotenoids	α-tocopherol (Vit E)	Astaxanthin	Lutéin	α-caroten	β-caroten	Lycopen
Males	7.91±0.09[a]	13.79	0.051	0	0.216	0.637	0
Females	8.68±0.22[a]	12.53	0.035	0	0.409	1.116	0.009
Eggs	15.45±1.93[b]	24.03	0.042	0.005	0.437	1.337	0.005

The values presented for total carotenoids are averages and their standard deviation (X, σ), (n 3),and in the same column, values carrying the different letters are significantly different with (p 0,05).

Eggs has significant highest contents in total carotenoids (15.48±1.9µg/g), vitamin E: alpha-tocopherol (24.03µg/g), alpha- carotene (0.437µg/g) and beta-carotene (1.337µg/g). Beta-carotene (0.637, 1.116 and 1.337µg/g in males, female and eggs respectively) was the most abundant carotenoid followed by alpha-carotene (0.216, 0.409 and 0.437µg/g respectively) and astaxanthine (0.051, 0.035 and 0.042µg/g respectively). Lycopen was not found in males in contrary of females and eggs. Eggs were found with little levels of lutein (0.005g/g) which in turn was absent in males and females edible parts. Zeaxanthin and beta-cryptoxanthin were not found in *C. turnerana*.

4. Discussion

Average weight and length of *C. Turnerana* found are above those usually consumed by local populations. This shows that shrimps used in this study were adults. The length of adult *C. turnerana* normally varied from 5.5±2.2 to 14.5±5.7cm (Holthuis, 1991).

4.1 Proximal Composition

The level of moisture recorded in this study was lower than the range value (75-80%) reported in previous works in other shrimps (Ekpenyong, Williams & Osakpa, 2013; Dincer, & Ayidin, 2014).

Protein contents of *C. turnerana* were lower than those of *Penaeus semislcatus* from Arabian Gulf described by Musaiger & D’Souza Musaiger (2008), and in flesh of *M. macrobranchiun* (Ekpenyong et al., 2013). However they were higher than those of *Penaeus monodon* (9.21%) and *P. notialis* (6.09%) (Bernard & Yewande-Bolatio, 2016). These high values of proteins indicated that *C. turnerana* is a good source of proteins. With fat content more than 10%, *C. turnerana* belongs to the fat species class of shellfish. Ash contents were lower than those found in *P. monodon* (3.53±0.06%), *P. notialis* (4.89±0.03%)(Bernard & Yewande-Bolatio, 2016; Oksuz et al., 2009) and in of *Metapenaeus affinis* (1.1% and 1.86±0.08% for male and female respectively)(Dincer, & Ayidin, 2014)**.** Carbohydrate values found in *C. turnerana* edible parts were higher when compared to the other shrimp's species (Dincer, & Ayidin, 2014). High level of carbohydrate found in males and females' edible parts could be explained by occurrence of low calcified shell rich in chitin and by the glycogen stored in muscle, responsible for their sweet taste. This high level of carbohydrate indicates that as stated by Varadharajan & Soundarapandian (2014) fat were not the only energy stock in shrimps, but also carbohydrate. Similar reports were found in *P. monodon* and *P. notialis* from Nigeria (Bernard & Yewande-Bolatio, 2016).

4.2 Mineral Contents

4.2.1 Macroelements (Na, K, P, Ca, Mg)

Sodium was the most abundant element of *C. turnerana*. This result corroborate those reported by Ravichandran et al. (2012) in *Penaeus indicus* and Gunalan et al. (2013) in *Litopenaeus vannamei*. These authors reported high level in Na compared to potassium. This result is however contrary to work reported by Bello (2013) on *Penaeus notialis* where potassium levels were higher than sodium levels. Sodium and potassium play an important role in the body. Sodium is the main regulator of extracellular liquid, which maintain the acido-basic equilibrium, it activates enzymes and maintain osmotic equilibrium which is essential for the nervous system. Daily requirement of Na is about 1.5g. Potassium helps to maintain the fluid electrolytes balance and the integrity of the cells during the nervous transmission and the muscle contraction. Daily requirement of potassium is about 2g (Rodwell, 1994). Higher levels of Na compared to potassium in this study increase the Na/K ratios with values ranging between 3.37% and 3.54%. This ratio is in fact, a key parameter to maintain the water equilibrium of the body, and is generally less than 1 in many foods (Bu, 2012; Perez, Ellen, & Chang, 2014). The high Na/K ratios up than 1 recorded indicate that *C. turnerana* is very useful and well adapted for persons suffering for burns and deshydratation. The Ca/P ratio is less than 1; showing that phosphorus was most abundant than calcium in *C. turnerana*. Similar results were reported by Babu et al. (2010) in *Bursa spinosa*, a gastropod of the indian coasts and by Ehigiator and Oterai (2012) in *Macrobrachium vollenhovenii* from Benin. The normal value of this Ca/P ratio in food is approximately 1 (Belitz, Crock, & Schieberie, 2009). Phosphorus is one of the essential components of nucleic acids and nucleoproteins implied in cellular division and transmission of hereditary features. It also acts like a key substance for the release of energy (Golub, 2011). Its daily requirement is approximately 1.2 g. Similar results were obtained by Ehigiator and Oterai (2012) in the flesh of *Macrobrachium vollenhovenii* from Benin.

The magnesium contents (0.17±0.003-0.205±0.00%) obtained are higher than those found by Adeyeye et al. (Adeyeye, Adebiora & Awodola, 2008) (0.021g/100g) in the pink shrimp, *Penaeus notialis* from Nigeria and by Ehigiator and Oterai (2012) in the flesh of *Macrobrachium vollenhovenii* from Benin (0.020g/100g). Magnesium is necessary for the enzymatic system of the body. It has a major role for the synthesis of proteins of marrowy tissue and takes part in the energy metabolism. The daily needs are approximately of 0.35 g (Rodwell, 1994).

4.2.2 Microelements (Fe, Zn, Cu, and Mn)

Iron contents of *C. turnerana* (6.29±2.96-7.60±0.49mg/100g) were higher than those found by Abdullah et al. (2009) in the pink shrimp *Parapenaeus longirostris* (1.8mg/g) and in red *Parapenaeus martia* (0.2 mg/100g) from Turkey. However, these contents were lower than those found by Adeyeye et al. (2008) in the pink shrimp *Panaeus notialis* (16.6mg/100g) from Nigeria and by Bernard and Yewande-Bolatio (2016) in *Penaeus notialis* (28.05mg/100g) and *Penaeus monodon* (41.25 mg/100g) from the South-west of the same country. Iron (Fe) is used for oxygen transport, necessary to the energy production in cells, particular in muscular cells and is essential to the formation of the red blood cells, and synthesis of hormones and neurotransmettors (Camara et al., 205). The daily requirements out of iron are 1 to 3 mg/day (Rodwell, 1994). Zinc contents of *C. turnerana* (3.62±1.03-7.62±0.35mg/100g) were higher than those found by Sriket et al. (2007) in *Panaeus monodon* (1.73mg/100g) and *Litopanaeus vannamei* (1.47 mg/100g) from Thaïland and by Ehigiator and Oterai (2012) in *Macrobrachium vollenhovenii*'s flesh (1.16 ± 0.06 mg/100g) from Benin. These important values show that *C. turnerana* is a good source of zinc. This mineral is found in all body tissue and is component of more than 300 enzymes where it acts as cofactor. It takes part in immune reactions, synthesis of the genetic material, perception of the taste, healing of wounds and in foetal development. The daily requirements of zinc are of 8 to 10 mg (Bender, 1992). High content of copper in the eggs (10.15± 3.57 mg/100g) and in the edible parts of the males (3.36 ± 0.35mg/100g) and females (4.05 ± 1.12 mg/100g) show that *C turnerana* is a good source of copper. These contents found in the edible part of the males and females are similar to those reported by Bernard and Yewande-Bolatio (2016) in *Penaeus notialis* (3.7mg/100g) from the South-west of Nigeria. The daily requirements of copper are 1 to 2 mg. Copper (Cu) participate in the synthesis of hemoglobin and collagen and is one of the components of several enzymes. The complex copper-enzyme contributes to the protection of the body against the free radicals (Thanonkaevw, 2006). Manganese contents of the edible parts of the studied shrimp are similar to those found by Adeyeye et al. (2008) in Nigeria pink shrimp, *Paneus notialis* (0,6mg/100g), but remain higher compared to those reported by Abdullah et al. (2009) in the pink shrimp *Parapenaeus longirostris* (0.07mg/100g) and in the red shrimp *Parapenaeus martia* (0.01mg/100g), and by Sriket et al. (2007) in *Panaeus monodon* (0,1mg/100g) and *Litopanaeus vannamei* (0,048mg/100g). Manganese is an activator of the pyruvate carboxylase and help for minerals fixation (Rodwell, 1994).

Results showed that *C. turnerana* with high contents in macro and microelements is a potential source of minerals which are vita for healthy growth, development of the body, functioning of the nervous system. It can be used in fighting against micronutrient deficiencies.

4.3 Contents of Total Carotenoids, Vitamin E and Carotenoids Profile

Total carotenoids contents for the edible parts were lower than those found by Sachindra et al. (2005) in *Panaeus indicus* (10.4 ± 0.92 µg/g) and *Metapaneus dobsonii* (11.1 ± 1.61 µg/g). However that of eggs approaches the values found by the same author on *Penaeus monodon* and *Parapenaeopsis stylifera* which were respectively of 17.4±5.99 µg/g and 16.0 ± 2.21 µg/g and by Sachindra et al. (2006) in the shrimp *Solonocera indica* (15.9 ± 2.1 µg/g).

Vitamin E (α-tocopherol) contents obtained in this study were lower than those found by Chellaram et al. (2014) in *Panaeus monodon* (56.71 µg/g). This liposoluble vitamin is a powerful antioxydant whose activity is 10 times higher than that of vitamin A. It plays a major role in the neutralization of the free radicals, thus slowing down cellular ageing and preventing the oxidation of the polyunsaturated fatty acids (Kanazawa, 1985).

High levels of α-carotene and β-carotene in *C. turnerana* showed that it is a good source of provitamins A for human. Niamnuy et al. (2008) reported that the major carotenoids in shrimps were the astaxanthin and its esters.Sachindra et al. (2005) reported that they can contribute to 63.5 - 92.2 % of total carotenoids of shrimps, with small percentages of β- carotene and of zeaxanthin. These results do not corroborate those found in the literature. Indeed, in *C turnerana*, astaxanthin was not the major pigment. The β-carotene content is about 3 times that of α-carotene in the males, females and eggs. It represents approximately 12.5 times the content of astaxanthin in the males, 32 times in the females and the eggs. Scarmo et al. (2010) report that the most widespread carotenoids in human plasma were: β-caroten, α-caroten, the β- cryptoxanthin, lutein, lycopen and zeaxanthin. *C. turnerana* would be thus a significant source of carotene for the human.

5. Conclusion

This study showed that *Callianassa turnerana* has a poor water content and is rich in lipids, proteins and carbohydrates. The more abundant macroelements were sodium and phosphorus, and the main microelements were iron, zinc and copper. *C. turnerana* is also rich in vitamin E (α-tocopherol) and in total carotenoids. β-carotene was the main carotenoid in *C. turnerana*, followed by α-carotene and astaxanthin. With high levels of macro and micronutrients, *C. turnerana* is a good source of many nutrients and essential elements.

Recommendation

C. turnerana can be recommended for human consumption to improve health and nutritional status of populations.

Significant Statement

This study is the first on chemical and biochemical of *C. turnerana* from Cameroonian water. The findings on its chemical composition will be helpful for further nutritional research on Cameroonian shrimp's species and marine foods.

Conflict of Interest

The authors declare no conflicts of interest related to this research work

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