

## SURVEY OF SOME CHEMICAL COMPOSITIONS AND FATTY ACIDS IN MEET OF CULTURED COMMON CARP (*CYPRINUS CARPIO*) AND GRASS CARP (*CTENOPHARYNGODON IDELLA*)

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### PREGLED NEKIH HEMIJSKIH JEDINJENJA I MASNIH KISELINA U MESU GAJENOG ŠARANA (*CYPRINUS CARPIO*) I BELOG AMURA (*CTENOPHARYNGODON IDELLA*)

#### **Abstract**

This study was conducted to determine of some chemical compounds (proteins, lipids, moisture and ash) and fatty acids in cultured two species of common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon idella*). Results of this study showed that the amount of saturated fatty acids (SFA) in common carp and grass carp were  $35.21 \pm 2.19\%$  and  $27.18 \pm 2.63\%$ , respectively and saturated fatty acids (SFA) in common carp was higher compared to grass carp ( $p < 0.05$ ). Levels of polyunsaturated fatty acids (PUFA) in the common carp and Grass carp were  $23.5 \pm 2.59$  and  $31.55 \pm 1.38\%$ , respectively and there was significant difference between the two species ( $p < 0.05$ ). Mono unsaturated fatty acids (MUFA) in the common carp and Grass carp were  $31.41 \pm 2.06$  and  $35.12 \pm 1.78\%$ , respectively. There was no significant difference in MUFA between the two species ( $p > 0.05$ ). This study showed that PUFA was higher than SFA in Grass carp while SFA was higher than PUFA in common carp. There were significant differences in protein, lipid and moisture in two species ( $p < 0.05$ ) but there was no significant difference the amount of ash in two fish species ( $p > 0.05$ ).

**Key words:** Chemical composition, Fatty acid, Common Carp (*Cyprinus carpio*), Grass carp (*Ctenopharyngodon idella*)

## INTRODUCTION

Fish and other sea food consumption increased in recent years and demand for sea products is growing with the increasing of population, income and also priority of sea products toward other food. Fishes have essential unsaturated fatty acids, protein with high biological value, minerals and vitamins that makes them distinguished from other creatures (Stolyhwo et al ,2006). Also fishes have large amounts of essential amino acids including Lysine that the level of this amino acid in fishes is more than plants (plant food). The most important and noticeable properties in fish oil, is the presence of abundant unsaturated fatty acids. Fish oil have a large amounts of essential fatty acids like ( $C_{20}:5n-3$ ,EPA), ( $C_{22}:6n-3$ ,DHA) and ( $C_{20}:4n-6$ ,ARA) that couldn't be recognized by human's body, so their existence in human's food is necessary. So many researches showed that fatty acids have a vital role in the correct functioning of cardiovascular system, nervous system, reproduction and immune system. And also involved in many processes of cell membrane and biochemical of body (palmeri et al ,2007). Cell membrane structure mainly formed by fatty acids in body. Cell membrane permit the level of essential amount nutrients to enter into cells and the wastes to get out rapidly from cells. For cells to be able to exchange the nutrients and the wastes, fluidity cell membrane should maintain its stability and integrity. Cells lacking healthy membrane lose the ability for holding water and nutrients and also lose the ability to communicate with other cells. Since the cell membrane consists of fat so their fluidity and flexibility depends on the type of fat consumed. Consumption of saturated (hydrogenated) makes the cell membrane hard and rigid and cause cell membrane fluidity against consumption of unsaturated fatty acids.

Fish body like other animals have water, protein, non-protein nitrogen compounds, fat, minerals, vitamins, and low amount of hydrocarbon. The amount of these ingredients and their changes in fish body can be used as an indicator for physiological conditions. Chemicals in fish muscle is different and is based on the (type) species, ration and diet composition, farming operation and environmental conditions (Sidhu, 2003), size, age, reproductive cycle, salinity, temperature, geographical location and fishing season (Inhamuns et al., 2008) and genetic factors in muscle (Bayir et al., 2006) (Inhamuns et al., 2008; Bayir et al., 2006).

Due to fishing restriction in water resources, aquaculture is the only way which is answerable to the increasing demand for fish and sea food (Cahu et al., 2004). *Cyprinus carpio* and *Ctenopharyngodon idella* are two species of fishes that could be seen in most environment and due to rapid growth, easiness of breeding and high food efficiency they are cultured in almost all places in the world (Tokur et al., 2006). These two species are counted as the important farming species in Iran , as now are included about 50% of fish in warm water fish ponds. Accordingly, considering abundance of producing these two species, surveying their body composition is very important. According to the subjects said about the nutritional value of fishes, this study has been done for investigating the level of fatty acids and some chemicals (protein, lipid, moisture and ash) of these two species muscle tissue.

## MATERIALS AND METHODS

### Sampling

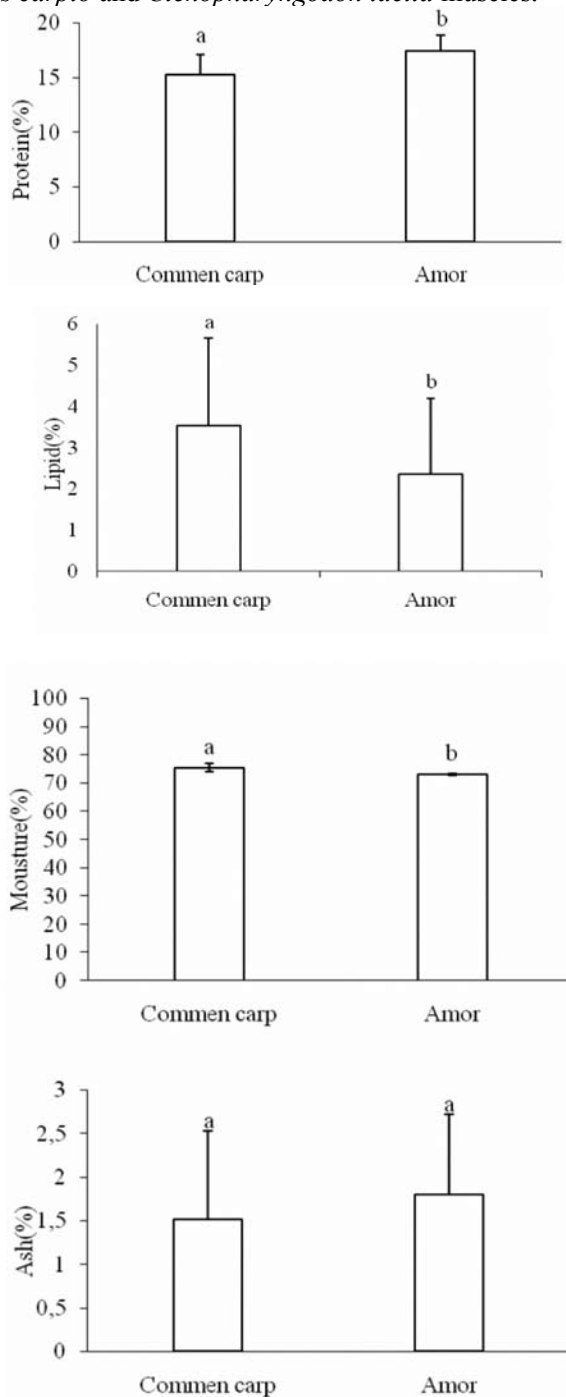
Fishes *Cyprinus carpio* and *Ctenopharyngodon idella* were obtained from one of the fish ponds of Noshahr on July 2009. They were all kept in iced boxes and transported to the laboratory where they were washed with cold water, weighed and measured. The average length and weight were  $37 \pm 1$  cm and  $860 \pm 72$  g for the cultured *Cyprinus carpio* and  $50 \pm 1$  cm and  $900 \pm 50$  g for *Ctenopharyngodon idella*. Total protein was determined by the Kjeldahl method (Ritzmann and Daniels, 1975) by which the concentration of nitrogen is measured. A conversion factor of 6.25 was used to convert total nitrogen to crude protein for all varieties of fish. The muscle was homogenized in a food processor (Braun Combimax 600), and moisture content of 5 g of homogenized sample was determined by drying the sample in an oven at  $105^\circ\text{C}$  until a constant mass was obtained (AOAC, 1990). Ash was determined by using the basic AOAC method (1990) heating the samples in the furnace at  $550^\circ\text{C}$  for 8–12 h. The analyses were repeated three times, and the results are presented as mean S.D. of determinations for triplicate samples. The lipids were extracted using a modified method of Bligh and Dyer (1959). Accordingly after homogenizing tissue samples, on (1 gram) of uniformed tissue, 15 milliliter of mixed chloroform/methanol added for extracting lipid. Then by using distilled water to put the mixture into three phases and its lipid separated like solution in chloroform. Then by using thermal (about  $50^\circ\text{C}$  to  $70^\circ\text{C}$  and very low flow of nitrogen gas), solvent firing happened and its approximate weight calculated. For this reason the desired lipid in all cases was about 0/05 gram (Folch et al., 1957). Then with the methylation process, fatty acid methyl esters dissolved in hexane were obtained. Finally 1 microlitre of this solution injected to Gas Chromatography (GC) model HP-6820 for identifying fatty acids (AOAC, 1990). To identify fatty acids in each sample, 37 pieces mixed fatty acids of Supelco Company was used.

### Statistical analysis

After gathering and data entry at first their normality was investigated by kolmogorov-smirnov test. Significant difference among chemicals between two fishes was determined by using T test about 5% probabilities. All statistical analysis was done by SPSS(ver. 19.5) software.

## RESULTS

Results of chemical compounds (protein, lipid, ash and moisture) reported in muscle tissue of both *Cyprinus carpio* and *Ctenopharyngodon idella* in diagram 1. Considering the results, amount of protein in *Ctenopharyngodon idella* ( $17/41 \pm 1/47$  percent) was more than *Cyprinus carpio* ( $15/2 \pm 1/9$ ). ( $p < 0/05$ ). Amount of lipid in *Ctenopharyngodon idella*  $2/35 \pm 1/83$  percent and in *Cyprinus carpio* was  $3/53 \pm 2/12$  percent ( $p < 0/05$ ). Amount of ash in grass carp was  $1/8 \pm 0/92$  and in common carp  $1/5 \pm 1.02$  and there was no significant differences in muscle tissue of both fishes. Also results showed that there was a significant difference in muscle tissue of both fishes and in the level of moisture, as the amount of moisture in *Ctenopharyngodon idella* ( $73/1 \pm 10/38$  percent) was less than *Cyprinus carpio* ( $75/48 \pm 1/58$  percent) ( $p < 0/05$ ) (Graf 1).

**Graf 1.** *Cyprinus carpio* and *Ctenopharyngodon idella* muscles.

Amount of saturated fatty acids (SFA) and Mono unsaturated fatty acids (MUFA) in *Cyprinus carpio* muscles was orderly 35/21±2/19 percent and 31/24±2/06 percent. Also the amount of poly unsaturated fatty acids (PUFA) in *Cyprinus carpio* was 23/5±2/59. In *Ctenopharyngodon idella* the level of saturated fatty acids (SFA) and Mono unsaturated fatty acids (MUFA) was orderly 27/18±2/63 percent and 35/12±1/78. Also amount of poly unsaturated fatty acids (PUFA) in *Ctenopharyngodon idella* was 31/55±1/38 percent. Saturated fatty acids in *Cyprinus carpio* muscles is more than *Ctenopharyngodon idella* muscles ( $p<0/05$ )(diagram 1). The results of statistical analysis showed the total amount of Mono unsaturated fatty acids (MUFA) in *Cyprinus carpio* does not have any significant difference with its amount in *Ctenopharyngodon idella*( $p<0/05$ ). Also the amount of poly unsaturated fatty acids (PUFA) in *Cyprinus carpio* was less than *Ctenopharyngodon idella* ( $P<0/05$ ). In *Ctenopharyngodon idella* poly unsaturated fatty acids was more than saturated fatty acids while in *Ctenopharyngodon idella* poly saturated fatty acids was more than poly unsaturated fatty acids. Amount of n-3/n-6 in *Ctenopharyngodon idella* was 0/52±0/03 and in *Cyprinus carpio* was 0/82±0/13 and there was no significant difference between two species ( $p<0/05$ ). Also PUFA/SFA ratio in *Ctenopharyngodon idella* (1/04±0/10) was more than *Cyprinus carpio* (0/71±0/03) ( $p<0/05$ ) (table1).

**Table 1.** Comparison of amount of fatty acids in cultured *Cyprinus carpio* and *Ctenopharyngodon idella* muscles (N=10)

\*Our data is expressed based on average ± standard deviation. Different letters in each column show the significant difference( $P<0/05$ ).

spices	PUFA/SFA	n-3/n-6	EPA+DHA	PUFA	MUFA	SFA
Common carp	0/71±0/04 <sup>a</sup>	0/82 ± 0/18 <sup>a</sup>	7/81 ± 0/19 <sup>a</sup>	23/5±0/2 <sup>a</sup>	37/41 ± 1/2 <sup>a</sup>	35/21± 3/32 <sup>a</sup>
Grass carp	1/04 ±0/6 <sup>b</sup>	0/52 ± 0/35 <sup>a</sup>	6/68 ±2/14 <sup>a</sup>	31/55±3/12 <sup>b</sup>	35/12 ±0/9 <sup>a</sup>	27/18± 0/54 <sup>b</sup>

## DISCUSSION

In this survey investigation was done on two species of *Ctenopharyngodon idella* and *Cyprinus carpio*. Investigating chemicals of freshwater fishes is very important because useful information for experts related to food resources having low fat, high protein, and being easily accessible. In this survey level of moisture in *Cyprinus carpio* was 5/48±1/57 percent and in *Ctenopharyngodon idella* was 73/11±0/38 that was according to the findings of others in this background (Islam& Jaadder, 2005; Abii et al., 2007). Fishes based on their body fat are divided into three categories lean(fat lower than 5 percent) fishes with average fat ( fat between 5-10 percent) and fatty fishes ( fat more than 10 percent) (Suriah et al., 1995). In this survey the amount of fat in *Cyprinus carpio* and *Ctenopharyngodon idella* was orderly 3/53±2/12 and 2/53 ±1/83percent that by said categorization, the investigated fishes was of lean fishes which was different in this background by Jabben & Chaudhry's findings (2011) which was likely because of sampling location, sampling season, nutrition condition of fish , environmental condition, size and age and etc. the amount of protein in *Ctenopharyngodon idella* was 17/41 ±1/47percent and in *Cyprinus carpio* was 15/2±1/9 percent which was according to Khorramgah et al., (2007) findings.also the amount of ash in this survey was more

than Khorramgah et al., (2007). So many surveys showed that chemical compounds in fish muscles in different species or even in one species has difference depends on gender, age, environmental condition and season. According to the shown results, chemical compounds of two cultured fishes *Ctenopharyngodon idella* and *Cyprinus carpio* considering being in the same environmental condition, having differences with each other and with other done study in this background.

Cultured *Cyprinus carpio* have more saturated fatty acids (SFA) than cultured *Ctenopharyngodon idella*, while the amount of poly unsaturated fatty acids in *Cyprinus carpio* is less than its amount in *Ctenopharyngodon idella*. This difference could be related to the type of feeding and culture system. *Cyprinus carpio* that cultured as a semi-extensive in the earth ponds, mainly depends on natural foods and benthic communities in the ponds, while *Ctenopharyngodon idella* has herbivore diet and in addition to feeding from reed around the earth pond, fed manually by forage and hay (Khorramgah et al 2007).

Transferring of PUFA and particularly EPA and DHA in fish food chain shows which normally plankton feeders has the highest PUFA and benthic carnivores feeds from invertebrates, has the lowest amount of PUFA (Arrayed et al., 1999). Considering type of food diet in *Cyprinus carpio* toward herbivora *Ctenopharyngodon idella*, and that the benthic invertebrates form much of the foods of *Cyprinus carpio*, in this survey also the amount of PUFA in *Cyprinus carpio* and *Ctenopharyngodon idella* is less than the amount of MUFA. The lowest amount suggested for PUFA/SFA ratio, is 0/45 (HMSO, 1994) which in this study for *Cyprinus carpio* calculated 0/71 and for *Ctenopharyngodon idella* calculated 1/04.

n-3/n-6 ratio, is the appropriate indicator for relative comparison of nutritional value of fish fat (Tokur et al., 2006). Generally amount of n-6 among freshwater fishes is more than n-3 (Jabeen & Chaudhry 2011). Also in present study like cultured *Cyprinus carpio* or wild one (Khorramgah et al., 2007) and cultured channel catfish (Tokur et al., 2006), and higher amount of omega-6 than omega-3 was observed in cultured *Cyprinus carpio* and *Ctenopharyngodon idella*. Lots of surveys showed that the amount of saturated fatty acids in freshwater fishes is more than unsaturated fatty acids. In this survey the amount of saturated fatty acids in *Cyprinus carpio* was more than unsaturated fatty acids but in *Ctenopharyngodon idella* unsaturated fatty acids was more than saturated fatty acids that it likely because of the type of feeding of *Ctenopharyngodon idella* that feeds from plants.

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