AACL BIOFLUX

Aquaculture, Aquarium, Conservation & Legislation
International Journal of the Bioflux Society

Chemical composition of meat in two cyprinid species

Valerica Macovei, Ioan Gîlcă, Benone Păsărin

University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Faculty of Animal Sciences, Iaşi, Romania, EU.
Corresponding author: V. Macovei, m_valerica_univagro@yahoo.com

Abstract. The biochemical analyses of the meat were determined in two species of carps, respectively *Cyprinus carpio* and *Ctenopharyngodon idella.* We worked on four groups of 10 fishes each (two groups for *C. carpio* and two groups for *Ct. idella*). One group from both species was fed with special fodder, and the other two groups were fed with clover (*Trifolium pratense)* and reeds (*Phragmites communis)* for *C. carpio* and *Ct. idella* respectively. The determination was made in the laboratory of chemical analyses of the Faculty of Animal Sciences, University of Agricultural Sciences and Veterinary Medicine Iaşi and we determined the content of the meat in proteins, fat, dry substance and minerals. The characteristic chemicals of the meat were determined on the extracted sample from the lateral musculature of the body. Biochemical analysis of meat from the four carp lots shows that protein content of meat is higher in groups which received combined feed compared to group which individuals were fed with natural food. Therefore, in case of feeding fish with combined fodder the protein content of meat increases, which proves a good recovery of protein in feed. Fat content and minerals in cyprinid meat are both higher in individuals fed with combined feed compared to those fed with natural components. When fat content in meat is higher, the dry matter content in meat is higher.

Key words: fish, carps, proteins, fat, dry substance, minerals.

Tartalom. Az izomzat biokémiai vizsgálatai két pontyfélén, a *Cyprinus carpio* és a *Ctenopharyngodon idella* voltak végrehajtva. Mindkét halfajból két-két kisérleticsoportot alakítottunk, mindegyik csoport 10 egyedből állt. Mindkét halfaj esetén az I. csoport kombinált tápot, a II. csoport lóhereből (*Trifolium pratense*) és nádból (*Phragmites communis*) álló zoldtakarmányt kapott. A laborvizsgálatok a „Iaşi"- I, "Mezőgazdasági és Állatorvosi Egyetem" Állattenyésztesi karán voltak elvégezve. A fennebb említett vizsgálatok, a két halfaj izomzatának fehérje, zsír, száraz és ásványi anyag szintjét celozták. A mintákat a halak oldalsó izomzatából gyüjtöttuk. Eredményeink arra a következtetésre jutattak, hogy a kombinált táppal etetett egyedek izomzatának feherjeszintje magasabb mint a zöldtakarmányban reszesülöké. A zsírokat és az ásványi anyagokat illetően, ugyanarra az eredményekre jutottunk, vagyis a granulált táppal való takarmányozás jobb felszívodást és beépülést bisztosít. A fentiek alapján azt állíthatjuk, hogy a zsírtartalom növekedése egyenesen arányos a szárazanyag tartalom növekedésével.

Kulcsszavak: Hal, pontyfélék, fehérje, zsír, szárazanyag.

Rezumat. Analizele biochimice ale cărnii s-au determinat la două specii de ciprinide, respectiv *Cyprinus carpio* şi *Ctenopharyngodon idella.* Pentru fiecare specie s-au constituit câte două loturi de câte 10 indivizi, în care un lot din fiecare specie a primit ca hrană nutreţ combinat, iar celălalte loturi trifoi (*Trifolium pratense)* masă verde şi stuf (*Phragmites communis)*. Determinările au fost efectuate în laboratorul de analize chimice din cadrul facultăţii de Zootehnie al Universităţii de Ştiinţe Agricole şi Medicină Veterinară Iaşi şi au vizat determinarea conţinutului cărnii la cele două specii de peşti în proteină, grăsime, substanţă uscată şi substanţe minerale. Caracteristicile chimice ale cărnii au fost determinate pe probe prelevate din musculatura laterală a corpului. Analizele biochimice ale cărnii arată că conținutul în proteină este mai mare în cazul loturilor furajate cu hrană combinată decât în loturile crescute cu hrană vegetală naturală. Aşadar, în cazul hrănirii peştilor cu furaj combinat, conținutul în proteină crește, ceea ce denotă o bună asimilare a proteinei furajului în mușchi. Conținutul de grăsimi și minerale în carnea ciprinidelor studiate sunt ambele mai mari la indivizii hrăniți cu furaj combinat decât la indivzii hrăniți cu componente naturale. Când conținutul de grăsime este mai ridicat, substanța uscată crește și ea.

Cuvinte cheie: peşte, ciprinide, proteină, grasimi, substanţă uscată.

Introduction. The quality of products represents all the characteristics of the value of items, expressing the degree to which they meet social needs, depending on the technical-economical parameters, aesthetics, the utility and efficiency in economic exploitation and in consumption (Banu 2002; Șara & Odagiu 2008; Mihăiescu & Mihăiescu 2008; Carșai 2009). The concept of meat quality is integrated in a broader concept, such as "The quality of food, complex and dynamic" (Pop 2005).

Among the factors that affect the quality of meat, the best known are the natural factors, the technical and the technological factors, the social factors and the human factor (Oprea 1997). To be marketed, the products must be safe, requirement that is found at both national (Romanian) and community level, in a number of general rules or specific groups of products (see Directive no 92/59 EEC, Directive no 93/43 EEC, Reglementation no 178/2002 EU, Government Decision 1198/2002, Law no 150/2004 etc).

Studies from literature focuse primarily on issues regarding the concept of quality of foodstuffs of animal origin, including on the one hand a number of issues regarding nutrition and diet of these products and on the other hand, issues related to how the livestock products are obtained, about the replacement of raw materials of animal origin and the food safety for human consumers. The quality of meat is also influenced by many factors such as species, sex, age, state of fattening of the individuals. In our experiments, in order to develop these knowledge, we determined some chemical characteristics (dry matter, protein, fat, minerals) of meat from the two fish's species, respectively *Ctenopharyngodon idella* (Valenciennes 1844) and *Cyprinus carpio* Linnaeus 1758 (for such studies see also Apetroaiei 1995).

In conditions of natural nutrition, since the age of one year, cyprinids eat almost with no preference from zooplankton and benthonic organisms to all kind of vegetals and even detritus (Battes 1985; Barnabe 1991). Natural food can be found in some portions of the intestinal tract (Misăilă 1998; Halga 2002) at any time during the period of feeding, mixed with scraps of food either before or after feeding. The frequency of animal components, or plankton, or demersal plant and even the organic and mineral debris is variable in different periods of carp feeding (Halver 1972; Oprea & Georgescu 2000).

In the case of common carp, the natural food has an important role in the digestion process and particularly in the digestion of proteins due to presence of own enzymes. The best evidence that natural food helps digestion processes is its own presence in intestinal contents of carp even when best quality additional feed is used (Bergot & Gregue 1983; Guillaume et al 1999).

Material and Method. The biological material was represented by two species of cyprinids, respectively *Cyprinus carpio,* two years aged and with a weight of 450g and *Ctenopharyngodon idella,* three years aged and with a weight of 900g. Both species were introduced into the buoyant Vivi that was installed in the same river water. The experiment was conducted during the vegetative period of 2008, in the Research Station of Aquaculture and Aquatic Ecology, Iaşi, for a period of 60 days. For each species, two groups of 10 individuals were made (E.1-E.2 and E.3-E.4); one group received as feed combined forage (E.1 and E.3), and the other group received clover (*Trifolium pratense* – in the case of common carp) green pasture (E.2) and reed (*Phragmites communis* – in the case of grass carp) (E.4). At the end of the experiment, individuals were slaughtered and analysis on the biochemical composition of meat from the two fish species, namely *Cyprinus carpio* and *Ctenopharyngodon idella*, were conducted.

These examinations were conducted in the laboratory of chemical analysis of the Faculty of Animal Husbandry - University of Agricultural Sciences and Veterinary Medicine Iași and we determined the content of fat, dry matter and mineral substances in fish meat. Chemical characteristics of meat were determined on samples taken from the lateral muscles of the body. Samples were subjected to chemical analysis, according to laboratory rules and to all recommendations and requirements of the current standards.

Laboratory tests allowed the determination of samples in **water** and **dry matter** by drying in the adjustable drying stove at the temperature of 105°C, **protein** by Kjeldahl method, which is based on determining total nitrogen in a sample, **fat** by

Soxhlet method, respectively fat extraction with organic solvents (petroleum ether) and **mineral** (ash) by burning samples in electric oven at a temperature of +550°C.

Results and Discussion. Results of biochemical analysis of meat from the two species of cyprinidae are shown in Table 1 and Figures 1-4. We observe that, in lots of *Cyprinus carpio* of two years age, (Tab. 1, Figs 1-2) protein meat ranges from 18.35% in lot E.1 and 16.98% in lot E.2; fat has values between 0.53% in group E.1 and 0.49% in the group E.2; the mineral substances (ash) values were between 1.10% in lot E.1 and 1.00% in lot E.2 lot. We found that in the group E.1 (control group) which received combined fodder, the meat protein content is higher with 7.4% compared to lot E.2, where individuals were fed with clover. Therefore, when combined fodder is used in the feeding of fish, the protein content of meat increases, which proves a good recovery of protein from feed.

Table 1

Comparative presentation of biochemical composition of meat in *C. carpio* and *Ct. idella*

Data	*Group*	*Species*	*Age years*	*Dry substances %*	*Proteins %*	*Fat %*	*Minerals %*
10 .09. 2008	E.1	*Cyprinus carpio*	2	20.49	18.35	0.53	1.10
	E.2	*Cyprinus carpio*	2	19.20	16.98	0.49	1.00
	E.3	*Ct. idella*	3	22.43	19.98	1.10	1.12
	E.4	*Ct. idella*	3	21.04	18.43	1.03	1.06

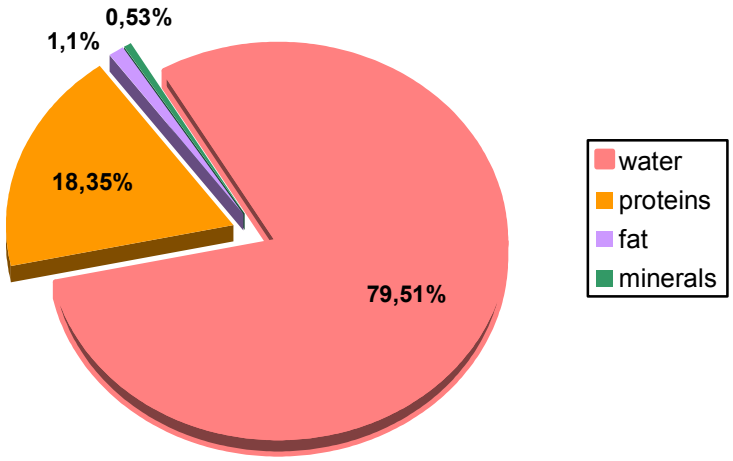

Figure 1. Chemical composition of meat in *Cyprinus carpio* — group E.1 (control)

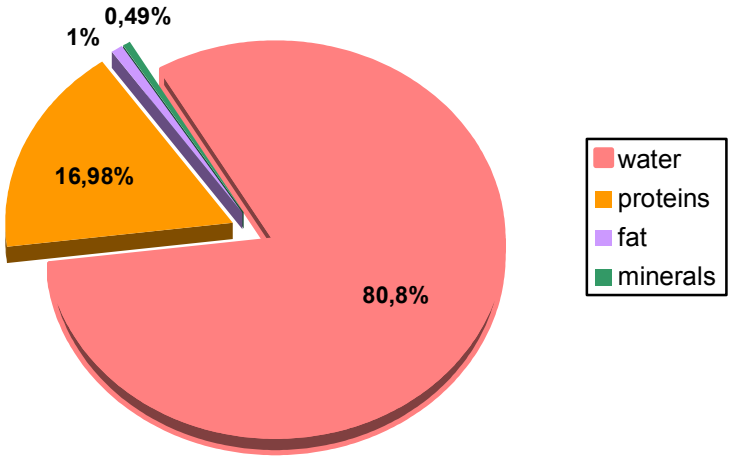

Figure 2. Chemical composition of meat in *Cyprinus carpio* — group E.2

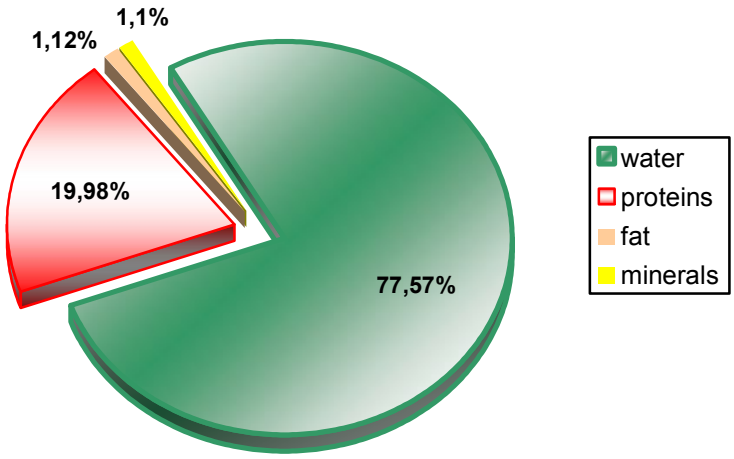

Figure 3. Chemical composition of meat in *Ctenopharyngodon idella* - group E.3 (control)

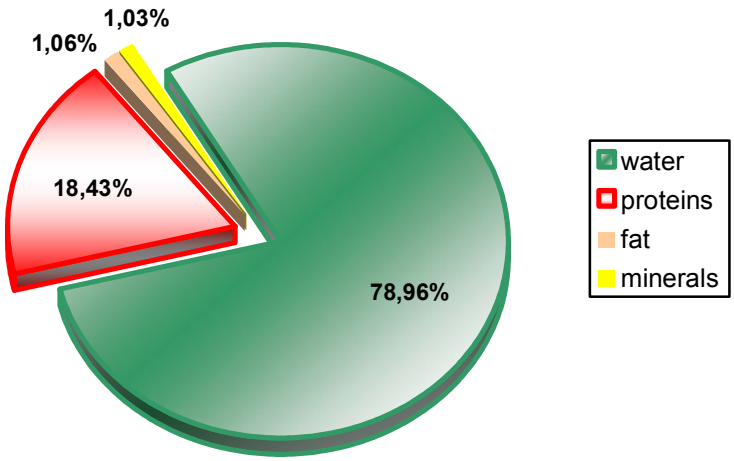

Figure 4. Chemical composition of meat in *Ctenopharyngodon idella* - group E.4

In the lots of *Ct. idella* of three years age, (Tab.1, Figs 3-4) protein from meat ranges from 19.98% in group E.3 to 18.43% in group E.4, fat between 1.10% in lot E.3 to 1.03% in lot E.4, respectively the minerals 1.12 in group E.3 to 1.06 in group E.4.

Oprea (1997) showed that values of protein in common carp meat in the first two years of age are between 15.42% and 17.64%, depending on the used diet. When fishes received additional food (combined feed), meat protein level was higher compared to the variants that were fed with natural food.

Fat content of meat from *C. carpio* is higher with 7.5% in individuals fed with combined feed compared to those fed with clover. Therefore, in order to reach an optimal state of fattening, the carp needs supplementary food. When the fat content in meat is higher, also the dry matter content is higher. Oprea (1997) indicated that the fat from the meat of common carp of two years age is ranging between 2.07 and 3.65%.

Minerals (ash), at the two lots of carp of two years age, have values somewhat higher in individuals fed with combined forage versus those fed with clover.

The results obtained for common carp and described above are similar in the case of grass carp - *Ct. idella* (see Tab.1).

In general, the results obtained by us through laboratory analysis concerning the biochemical composition of meat from cyprinids approach the data mentioned in literature.

Conclusions. Biochemical analyses of meat from the two common carp lots show that protein content of meat is higher with 7.4% in E.1 group (which received combined feed) compared to group E.2 (in which individuals were fed with clover). Therefore, in case of combined fodder feeding fish, the protein content of meat increases, which proves a good recovery of protein in feed.

Fat content in meat of *C. carpio* is higher with 7.5% in individuals fed with combined feed compared to those fed with clover. When fat content in meat is higher, the dry matter content in meat is higher.

At the two lots of common carp of two years age, ash has values somewhat higher in individuals fed with combined forage versus those fed with clover.

All the results shortly presented above were rather similar in the case of grass carp – *Ct. idella*.

Overall, our results on the biochemical composition of cyprinid meat approach the results from the literature.

References

Apetroaiei M., 1995 [Research regarding activity of some digestive enzymes and their biochemical characteristics in a few cyprinid and salmonid species reared in controlled systems. Doctoral Thesis, Univ."Al. I. Cuza" Iaşi], p.159-183. [In Romanian]

Banu C., 2002 [Quality and Control of Alimentary Products]. Agir, Bucharest. [In Romanian]

Barnabe G., 1991 [Biological and Ecological Bases of Aquaculture]. Lavoiser, Tec et Doc, Paris. [In French]

Battes K., Luca C., Pricope F., 1985 [Research regarding the common carp rearing in floating netcages]. Piscicultura Moldovei, vol I, p.261-269. [In Romanian]

Bergot P., Breque J., 1983 Digestibility of starch by rainbow trout effects of the physical state of starch and of the intake level. Aquaculture 34:203-212.

Carșai T.-C., 2009 Genetic markers assisted selection in cattle: leptine gene locus and its polymorphism. ABAH Bioflux 1(1):1-20.

Council Directive 92/59/EEC on general product safety, Official Journal of the European Communities no. L 228, 11.08.1992, p.24-32.

Council Directive 93/43/EEC on the hygiene of foodstuffs, Official Journal of the European Communities no. L 175, 19.07. 1993, *pp. 1-11.*

European Parliament and Council Regulation (EC) no 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety

Authority and laying down procedures in matters of food safety, Official Journal of the European Communities no. L 31, 1.2.2002, pp.1-24.
Guillaume J., Kaushik S., Bergot P., Metailler R., 1999 [Nutrition and Alimentation of Fishes and Crustaceans]. INRA, Paris, p.70-318. [In French]
Halga P., 2002 [Animal Alimentation]. Pim, Iași, Romania, p.465. [In Romanian]
Halver J. E., 1972 Fish Nutrition. Academic Press Inc., USA, p.320.
Mihăiescu T., Mihăiescu R., 2008 The assessment of the intensive poultry rearing farms within the context of the IPPC Directive (B). ProEnvironment 2:42-45.
Misăilă E. R., 1998 [Biochemical and Ecophysiological Research on Methabolical-Hematological Profile in Some Cultured Fish. Doctoral Thesis], p.58-70. [In Romanian]
Oprea L., Georgescu R., 2000 [Fish Nutrition and Alimentation]. Editura Tehnică, Bucharest, p. 272. [In Romanian]
Oprea L., 1997 [Research Concerning the Use of Fodder Pellets in Various Culture Systems. Doctoral Thesis, Universitatea "Dunărea de Jos" Galaţi], p. 212. [In Romanian]
Pop C., 2005 [Present interests in the alimentary quality and safety]. Revista de Zootehnie 3:10-14. [In Romanian]
Romanian Government Decision no. 1198 on foodstuff hygiene endorsment norms, Official Gazette no. 866, 2.12.2002.
Romanian Parliament, Law 150/2004 on food safety, Official Gazette no. 462, 24.05.2004.
Șara A., Odagiu A., 2008 Probiotics and minerals availability in organic animal farming. ProEnvironment 2:34-38.

Received: 30 March 2009. Accepted: 25 July 2009. Published: 26 July 2009.
Authors:
Valerica Macovei, University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Faculty of Animal Sciences, Iaşi, Romania, EU, e-mail: m_valerica_univagro@yahoo.com
Ioan Gîlcă, University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Faculty of Animal Sciences, Iaşi, Romania, EU, e-mail: not available.
Benone Păsărin, University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Faculty of Animal Sciences, Iaşi, Romania, EU, e-mail: pbeno@univagro-iasi.ro
How to cite this article:
Macovei V., Gîlcă I., Păsărin B., 2009 Chemical composition of meat in two cyprinid species. AACL Bioflux 2(3):293-298.
Printed version: ISSN 1844-8143
Online version: ISSN 1844-9166 available at: http://www.bioflux.com.ro/docs/2009.2.293-298.pdf
Paper presented in the International Symposium ACVAPEDIA, 28-29 April 2009, Timișoara.