

## NUTRITION OF COMMON CARP WITH FEED CONTAINING BY-PRODUCTS FROM THE SLAUGHTERHOUSE

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### ISHARANA ŠARANA SA HRANOM KOJA SADRŽI NUSPROIZVODE IZ KLANICE

#### *Apstrakt*

Nusproizvodi klanične industrije čine više od 50% prinosa prilikom klanja u zavisnosti od vrste životinje i korišćenje ovih sirovina, što je veoma važno za održivost klanične industrije. Pojedini nusproizvodi se koriste i u ishrani ljudi jer sadrže esencijalne hranjive materije. Cilj ovog rada je bio da se formuliše i proizvede hrana za ribe koja sadrži svinjske i goveđe jetre, pluća, slezine i želuca i da se ispita njen nutritivni kvalitet u ishrani šarana. Proizvodnja šarana je vršena tokom sezone 2014. na ribnjaku površine 3,5 ha koji je sagrađen u okviru objekata klanice „Agropapuk“ u Kukujevcima. 2100 kg jednogodišnjeg i dvogodišnjeg šarana je nasadeno, pri čemu je prosečna težina jednogodišnje ribe bila 60 g, a dvogodišnje 600 g. Tokom proizvodnog ciklusa u ishrani riba je korišćenja komercijalna smeša sa 32% proteina i 10% masti. Pored toga, korišćena je hrana koja je pripremljena kao smeša jestivih iznutrica dobijenih iz klanice u kombinaciji sa žitaricama. Na kraju sezone gajenja ukupna proizvodnja na ribnjaku je bila 7500 kg. Konverzija je iznosila 0,9, upotrebom komercijalne hrane i 0,8 sa hranom pripremljenom od jestivih iznutrica i žitarica. Dobijeni rezultati mogu doprineti povećanom iskorišćavanju nusproizvoda iz klanične industrije u proizvodnji hrane za ribe. Ishrana riba u tradicionalnom poluintenzivnom sistemu gajenja u Republici Srbiji je uglavnom zasnovana na upotrebi žitarica, pri čemu je lizin prva limitirajuća amino kiselina i inkorporacija nusproizvoda koji su bogati sa ovom amino kiselinom je od neosporivog značaja. Pored toga, korišćenje slezina u hrani za ribe doprinosi smanjenju pojave anemije kod ribe. Jestive iznutrice su veoma bogat izvor proteina, minerala, vitamina i drugih hranjivih materija. Iako broj zaklanih životinja raste, u mnogim

evropskim zemljama se zapaža trend smanjenja upotrebe jestivih iznutrica pogotovo posle pojave goveđe spongiformne encefalopatije (BSE), sa druge strane efikasno iskorišćavanje jestivih iznutrica je krucijalno kako za ekonomsku održivost klanične industrije, a isto tako i za očuvanje životne sredine. Postoji veoma malo podataka o korišćenju iznutrica u hrani za ribe. Dobijeni rezultati ukazuju na veoma dobre proizvodne parametre prilikom gajenja šarana sa upotrebom hrane koja sadrži nusproizvode klanične industrije. Imajući u vidu sve navedeno, jasno je da su dalja istraživanja o korišćenju nusproizvoda iz klanične industrije u ishrani riba neophodna. Efikasno iskorišćavanje nusproizvoda iz klanične industrije ima direktne pozitivne ekonomske efekte, kao i efekte na smanjenje zagađenja, dok njihovo ne-korišćenje može dovesti do ekonomskih i zdravstvenih posledica.

*Ključne reči: šaran, jestive iznutrice, parametric prirasta, ishrana*  
*Key words: common carp, edible offal, growth parameters, nutrition*

## INTRODUCTION

In Republic of Serbia, the slaughterhouse waste management system is generally very poor and only several measures are being taken for the effective management of wastes generated from slaughterhouses (Pelić, 2014). Meat by-products constitute about or more than 50% of the yields of slaughtering, depending upon the animal species slaughtered, and usage of such by-products is important for the viability of the meat industry (Subba, 2002). These by-products are also used for human nutrition, and one of the most important factor both in the utilization of meat by-products for human consumption is sensory acceptability. Edible meat by-products contain many essential nutrients. Liver is used as a fresh for preparing meals or in the industrial manufacture of sausage and different meat products. Spleen and lung are also edible but they are not highly acceptable by consumers, so porcine and bovine lung and spleen are mostly wasted. It is noteworthy that liver, lung and spleen are good sources of protein and of the essential amino acid lysine (Kitts and Weiler, 2003) while bovine spleen is a very rich source of iron (Lönnerdal et al., 2006). General, porcine and bovine liver represent rich sources of vitamin A (Ikeda et al., 2005). The objective of the present study was to develop a fish feed containing processed porcine and bovine lung, spleen liver and stomach and to evaluate its acceptability and nutritional quality for cyprinid fish species.

## MATERIAL AND METHODS

Production of carp was carried out during 2014 growing season at fish pond of 3.5 ha which was built near the slaughterhouse in Kukujevci. Hydrated lime was used in amount of 1000 kg/ha in April, May and June, while in July, August, September and October the amount of lime was 2000 kg/ha. 2100 kg of one- and two-year old common carp were stocked in the fish pond (Table 3). The average weight of a one year old carp was 60 g and two-year old carp was 600 g. During the production, commercial extruded fish feed, with 32% of proteins and 10% of fat, were given to fish. Besides that, feed in form of dough prepared as mixture of by-products obtained in a slaughterhouse with the addition of cereals was added. Fresh porcine and bovine spleen, lung, liver and stomach were obtained from

the slaughterhouse „Agropapuk“, Kukujevci, Republic of Serbia. Covering capsules and adhering fats were removed from the spleen. Trachea, aorta, bronchial tubes and adhering fat were removed from lung and the lung lobes were cut into slices. Spleen, lung liver and stomach were cooked in water at 90°C. The offal was then minced with grains in the coater to obtain the dough. Formulation of feed is given in Table 1. Feeding was carried out twice a day in 8 am, and the 3 pm. Moisture, protein, ash and crude fat were determined by the standard analytical methods of Scientific Veterinary Institute „Novi Sad“ (Sl. list SFRJ, 15/87; SRPS EN ISO 16634-1:2010; Sl. List SFRJ, čl 28/18; Sl. List SFRJ, 15/87, čl. 29/12). Chemical composition of fish feed (on dry matter basis) is given in Table 2.

## RESULTS

At the end of the growing season, the average weight of the two-year old carp was 900 g, respectively 3.8 kg for a three-year old carp. Harvesting weight was 7500 kg. FCR was 0.9 for commercial feed and 0.8 for additional dough feed prepared as mixture of by-products obtained in a slaughterhouse with the addition of cereals (Table 3). Mortality ranged 5% in two-year old carps, and 10% in one-year old carps.

**Table 1.** Formulation of feed (dough)

Ingredients	%
Porcine and bovine spleens	40
Porcine and bovine livers	10
Porcine and bovine lungs	10
Porcine and bovine stomach	10
Soybean meal	10
Wheat flour	10
Corn	6
Bran	2
Yeast	2

**Table 2.** Chemical composition of fish feed (on dry matter basis)

Nutrient	Content
Crude protein, %	29.82
Dry matter, %	46.62
Crude fiber, %	4.40
Crude fat, %	11.33
Crude ash, %	3.39

**Table 3.** Production parameters of common carp

Total stocking density	600 kg/ha
Stocking density of one year carp	200 kg/ha
Stocking density of two year carp	400 kg/ha
Harvesting density	2150 kg/ha
FCR for comercial feed	0.9
FCR for dough	0.8

## DISCUSSION

Obtained results could help to increase the consumption of slaughterhouse' offal and its utilization in fish feed processing. The traditional fish nutrition in semi-intensive culture systems in Republic of Serbia is cereal-based (Ljubojević et al., 2013ab). Lysine is the first limiting amino acid in cereals (Boisen et al., 2000) and the incorporation of lysine-rich by-products, such as lung, spleen and liver, in a cereal-based formulated fish feed can improve lysine intake of the cyprinids fish. Moreover, use of spleen in a formulated feed can be helpful in reducing anaemic health problems in fish (Adams and Thompson, 2006). According to results of Florek et al. (2012) the offal of livestock are abundant sources of protein comparable with protein from muscle tissue and macro- and micronutrients and such results help increase offal utilization in fish feed industry. Despite of the fact that the number of slaughtered animals has increased, the use of edible by-products for human consumption has declined (Florek et al., 2012). In majority European countries this trend has been strengthened by the appearance of bovine spongiform encephalopathy (BSE) that has given consumers a negative image of edible by-products, which consequently led to restriction of the use of edible offal in pet food (Selmane et al., 2008). On the other hand, efficient utilization of edible offal is essential in order to support economical and viable meat production systems (Kurt and Zorba, 2007). Only a limited number of studies are available on the composition of by-products from the slaughterhouses (Kurt and Zorba, 2007; Florek et al., 2012). Furthermore, the available literature concerning the composition and nutritional value of offal for fish nutrition is scarce. The favorable weight of the carp at harvesting is the result of good environmental conditions that were based on the use of well water, adequate flow, aeration, use of hydrated lime, quality of complete feed and feed supplements from the slaughter industry. Bearing in mind all the above mentioned facts, it is clear that further researches on the use of by-products from slaughterhouses in the diet of fish are required.

## CONCLUSION

Efficient utilization of by-products from slaughterhouse has direct positive impact on the economy and environmental pollution of the country, while non-utilization of animal by-products in a proper way may create major economical and catastrophic health problems. Besides hazard and pollution aspects, edible offal (by-products) from the slaughterhouses have a great potential for conversion into valuable sources of proteins and other nutrients in fish feed. Utilization of edible offal from the slaughterhouse leads to favourable growth of fish and satisfactory fish production.

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## REFERENCES

Adams, A., Thompson, K. D. (2006): Biotechnology offers revolution to fish health management. *Trends in biotechnology* 24, 201–205.

Boisen, S., Hvelplund, T., Weisbjerg, M. R. (2000): Ideal amino acid profiles as a basis for feed protein evaluation. *Livestock Production Science* 64, 239–251.

Florek, M., Litwińczuk, Z., Skalecki, P., Kędzierska-Matysek, M., Grodzicki, T. (2012): Chemical composition and inherent properties of offal from calves maintained under two production systems. *Meat science* 90, 402–409.

Ikeda, S., Kitagawa, M., Imai, H., Yamada, M. (2005): The roles of vitamin A for cytoplasmic maturation of bovine oocytes. *Journal of Reproduction and Development* 51, 23–35.

Kitts, D. D., Weiler, K. (2003): Bioactive proteins and peptides from food sources. Applications of bioprocesses used in isolation and recovery. *Current pharmaceutical design* 9, 1309–1323.

Kurt, S., Zorba, Ö. (2007): Emulsion characteristics of beef and sheep offal. *Journal of Muscle Foods* 18, 129–142.

Lønnerdal, B., Bryant, A., Liu, X., Theil, E. C. (2006): Iron absorption from soybean ferritin in nonanemic women. *The American journal of clinical nutrition* 83, 103–107.

Ljubojević, D., Ćirković, M., Novakov, N., Jovanović, R., Janković, S., Đorđević, V., Mašić, Z. (2013a): Productivity and Meat Nutrient in Fish: The Diet Effect. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi* 19, 1, 43–49.

Ljubojević, D., Ćirković, M., Đorđević, V., Puvača, N., Trbović, D., Vukadinov, J., Plavša, N. (2013b): Fat quality of marketable fresh water fish species in the Republic of Serbia. *Czech Journal of Food Sciences* 31, 445–450.

Pelić, M. (2014): The use of fishing technologies in sustainable development of slaughterhouse systems. University of Novi Sad, Novi Sad, Master thesis.

Selmane, D., Christophe, V., Gholamreza, D. (2008): Extraction of proteins from slaughterhouse by-products: Influence of operating conditions on functional properties. *Meat Science* 79, 640–647.

Subba, D. (2002): Acceptability and nutritive value of keropok-like snack containing meat offal. *International journal of food science & technology* 37, 681–685.