

# A COMPARISON OF ARTIFICIAL AND NATURAL FOODS AND THEIR COMBINATIONS IN THE REARING OF GOLDFISH, *CARASSIUS AURATUS* (L.)

Aurelia Nica<sup>1\*</sup>, I. Vasilean<sup>1</sup>, Adina Popescu<sup>1</sup>, Daniela Cristina Ibanescu<sup>1</sup>

<sup>1</sup>"Dunarea de Jos" University of Galati, Romania

## Abstract

Goldfish (*Carassius auratus*) are one of the most valuable fishes in the world. This study was conducted to evaluate the efficacy of natural food and commercial diets and their combinations in rearing of goldfish juveniles. The experiment took place between March 27 and May 8, 2017 and it began when fish had six weeks and an average weight of 88 mg. Three variants have been experimented: in the first variant, fish were fed exclusively with artificial dry diets, in the second variant, the fish were fed with artificial dry diets and natural food and in the third variant, the fish were fed only with natural food. In V<sub>1</sub> variant, was used Nutra 4 pellets with 62% crude protein; in V<sub>2</sub> variant was used Nutra 4 pellets and frozen cyclops, while in V<sub>3</sub> variant was used only frozen cyclops. After 48 days, the best results regarding the growth performance were recorded in V<sub>1</sub> variant.

It was concluded that goldfish can be reared during the start feeding phase on artificial as well as natural diets, and the artificial dry diets can be used exclusively from six weeks age.

**Key words:** goldfish, natural food, pellets, growth, aquarium

## INTRODUCTION

The ornamental fish sector is a widespread and global component of international trade, fisheries, aquaculture and development. Ornamental fish keeping is becoming popular as an easy and stress relieving hobby [4].

The goldfish, *Carassius auratus*, a member of the Carp family, *Cyprinidae*, has been domesticated for many hundreds of years, as a food fish, a laboratory animal and now most important commercially, for ornamental and aesthetic purposes [6].

A proper diet ensures healthy growth and a harmonious development of fish. Nutrition should provide fish the nutrients needed for growth and provide the energy indispensable to physiological processes [1].

Growth and survival data are powerful tools for understanding the effects of both natural and artificial food on feeding fish. In the present study, growth and survival data were evaluated to show the effect of natural

and artificial diet on juveniles of *Carassius auratus*.

## MATERIAL AND METHODS

The experiment was conducted for 48-day long from 27th March, 2017 to 8th May, 2017 in three glass aquariums with a capacity of 58 litres each, provided with independent filtration units, in the research laboratory of Aquaculture, Environmental Science and Cadastre from „Dunarea de Jos” University, Galati.

Biological material represented by goldfish, was obtained by induced breeding through injection with *Cyprparon* in 10th February. The experiment began when fish had six weeks and an average weight of 88 mg. Three variants have been experimented: in the first variant, fish were fed exclusively with artificial dry diets, in the second variant, the fish were fed with artificial dry diets and natural food and in the third variant, the fish were fed only with natural food.

The commercially available dry food was represented by Nutra 4 and natural food was represented by frozen cyclops. The pellets contain fish meal, fish oil, vital wheat gluten, wheat, maize gluten. Nutrient

\*Corresponding author: anica@ugal.ro

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compositions for pellets are given in Table 1 and for frozen cyclops are given in Table 2.

The weight of each individual fish used in the experiment was recorded using an electronic balance sensitive up to 0.001 g at the beginning and end the experiment. For comparison between diets, we calculated the technological indicators on a dry weight basis.

Table 1 Biochemical composition of pellets

Biochemical composition	UM	Value
Crude protein	%	62
Crude oils and fats	%	11
Crude fibre	%	0.8
Moisture content	%	9.0
Phosphorus	%	1.5

Table 2 Biochemical composition of cyclops

Biochemical composition	UM	Value
Crude protein	%	4.4
Crude oils and fats	%	1.3
Crude fibre	%	0.3
Moisture content	%	93.3
Ash	%	0.4

Appropriate aeration was done to supply adequate oxygen into the aquaria by compressor it was nonstop till the conclusion of the research. The tanks were drained twice a week and replenished with fresh water to remove accumulated feces from the bottom.

At the end of the experiment, after all fish were weighed and measured, the following technological efficiency indicators were calculated: growth rate, food conversion ratio, the protein efficiency ratio using the following equations:

Weight gain (W) = Final weight ( $W_1$ ) – Initial weight ( $W_0$ ) (g)

Food conversion ratio (FCR) = Total feed (F) / Total weight gain (W) (g/g)

Protein efficiency ratio (PER) = Total weight gain (W) / amount of protein fed (P) (g).

## RESULTS AND DISCUSSIONS

The quality and quantity of food are essential inseparable aspects of fish feeding. Various foods, similar in quantity and quality to the origin environment of the cultivated

species, ensures a harmonious development and good functioning of organisms and exotic fish, adapted to the aquarium conditions, in the temperate zone. This study deals with a comparison of frozen Cyclops and a commercially available dry food and their combination.

Adequate water quality parameters (pH, temperature and dissolved oxygen) were maintained throughout the period of the study in the tolerable limits for goldfish. This observation was important based on the fact that water quality attributes are prime factors that influence all biological productions, fish survival and adequate growth performance [3]. During the experiment, only three fish has dead, one in  $V_2$  variant and two in  $V_1$  variant.

Kaiser H. and all (2003) published a study on comparison of artificial and natural foods and their combinations in the rearing of goldfish and they concluded that, while the effect of combined feeding of dry food with natural food depended on experimental conditions, the slow growth observed in goldfish fed only dry food compared with the treatments fed live food [2].

In the present study, the highest body gains and length increases were achieved by goldfish juveniles fed on artificial food ( $V_1$  variant) (Table 3). This variant was following by  $V_2$  variant and then by  $V_3$  variant.

One of the simplest means for an aquaculture producer to assess feed performance is to determine a food conversion ratio (FCR). The FCR is the weight of food supplied divided by the weight gain of the fish during the feeding period.

Typically, the total feed utilization by fish, expressed as food conversion ratio (FCR), or the protein utilization, expressed as protein efficiency ratio (PER), are calculated. The highest quality production diets will have relatively low FCRs and high PERs [6]. In our experiment, the best results regarding FCR and PER were obtaining in  $V_2$  variant.

So, despite the fact that weight gain was much better in juveniles fed artificial diet ( $V_1$  variant) than those fed frozen live food ( $V_3$  variant) and their combination ( $V_2$  variant), the better results regarding food use was obtain in  $V_2$  variant.

Table 3 Technological indicators of growth

Parameter/Variant	V1	V2	V3
Initial total biomass (g)	8.8	8.8	8.8
Final total biomass (g)	103.98	68.68	35.023
Initial no. exp.	100	100	100
Final no. exp.	98	99	100
Initial mean body weight (g)	0.088	0.088	0.088
Final mean body weight (g)	1.06	0.69	0.35
Total increase growth (g)	95.18	59.88	26.22
Individual spore growth (g)	0.97	0.69	0.26
FCR	1.51	1.32	1.47
Protein Efficacy Rate	1.06	1.2	1.03

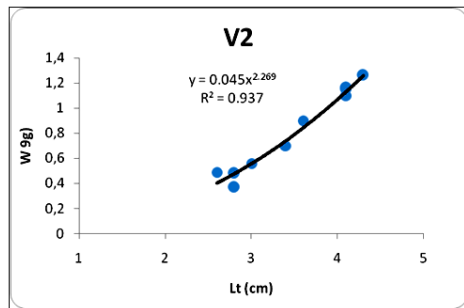
Fish fed with natural food showed excellent survival but growth rate was much slower than in groups fed with mixed food and artificial food.

At the end of the experiment, the determination of length - weight relationship (L - W) was done using the equation  $W = a * L^b$ , where: W - individual weight (g), L - total length (cm), a and b the regression constants.

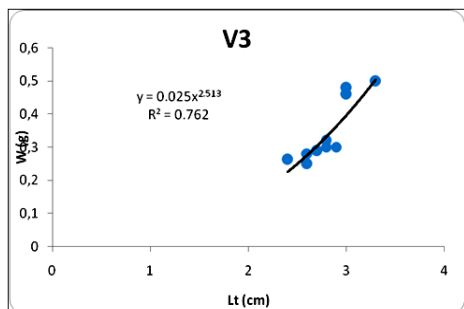
The regression curves show positive relationships between total length (Lt) and mass (W) in all experimental variants, the best regression coefficient being the first experimental variant.

The coefficient b (condition factor) in the length-to-mass relation takes values generally between 2 and 4 and is considered a measure of environmental conditions, being a generalization of the Fulton coefficient.

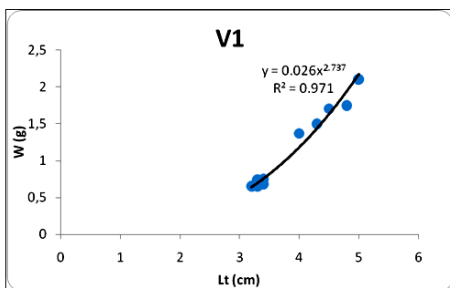
The value of the condition factor has the best value in experimental variant 1 (V1, b = 2.737) followed by V2 (b = 2.513). The smallest value of coefficient b is recorded in V2 (b = 2.269).



Regression for V<sub>2</sub> variant



Regression for V<sub>3</sub> variant



Regression for V<sub>1</sub> variant

## CONCLUSIONS

In the growth of the goldfish, it is necessary to take into account both a good increase of the biomass and the intensification of the color.

Goldfish can be reared during the start feeding phase on artificial as well as natural diets, and the artificial dry diets can be used exclusively from six weeks age.

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