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USE OF CHICKEN MEAL AS A SUBSTITUTE FOR FISH MEAL IN THE DIET OF YOUNG EELS

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A B S T R A C T. Six groups of young eels were fed pellets in which fish meal was substituted with chicken meal at rates of between 10 and 100%. Growth and survival data were collected. During the entire period of rearing the weight data of all the groups were very similar, but the group fed on the 100% chicken meal diet exhibited a significantly better growth performance than the other groups. Pelleted food prepared using chicken meal may be a useful substitute of fish meal in rearing of young eels.

Key words: YOUNG EELS, REARING, PELLETS, CHICKEN MEAL, GROWTH PERFORMANCE.

INTRODUCTION

Fish meal is the main source of protein and the most expensive component used for preparing pelleted food for growing eels. In Israel, where fish meal is imported, alternative sources of locally produced protein are needed. An attempt was made to substitute fish meal with chicken meal, a by - product of the poultry industry. Six groups of young eels were fed for two months with pelleted food in which fish meal was substituted by chicken meal in different proportions ranging from 10 to 100%.

MATERIALS AND METHODS

REARING FACILITY

The rearing system consisted of 6 glass aquaria, each of 60 L capacity, connected to a submerged biological gravel filter, sedimentation tank and pump-tank with submersible water-pump. A constant water-flow of 2.5 L/min and aeration were provided to each aquarium. About 45% fresh water was added to the system daily. The system was maintained at 25°C, 70% DO (dissolved oxygen), 0.5 mg/L total ammonia

and 0.25 mg/L nitrite. Faeces, uneaten food and dead fish were removed by syphoning.

STOCKING

Each aquarium was stocked with 50 young eels with an average individual weight of 24.0 g. A three week period of acclimation was used before the experiment during which the fish were fed with a commercial pelleted trout food (Taarovet, Israel) at a ratio of 2% of body weight daily. To establish that the fish were distributed in the aquaria equally by size, ANOVA test and standard t-test were applied to the fish weight data. No significant differences between the means of the groups (P=0.01) were found.

FEEDING PATTERN

Six experimental diets were tested, each consisting of the same proportions of soyabean meal, multivitamins, minerals and fish oil, while fish meal and chicken meal proportions differed (Table 1). The control diet contained 77% fish meal.

All dry components were micronized and mixed thoroughly with oil. 25-30% of water (of the total weight of the dry component) was added to the mixture before pelleting. The pellets were dried for 3-4 days. The size of pellets was 1-2 mm. The food was administered by hand at a ratio of 4% of body weight daily. No differences were observed in the feeding behaviour or feeding activity of fish fed different diets.

TABLE 1

Composition of the experimental diets (in %)

Group	1	2	3	4	5	6
Soybean meal	8	8	8	8	8	8
Multivitamins	3.5	3.5	3.5	3.5	3.6	3.5
Mixture of minerals	1.5	1.5	1.5	1.5	1.5	1.5
Fish oil	10	10	10	10	10	10
Fish meal and chicken meal	77	77	77	77	77	77
Substitution of fish meal by chicken meal	0	10	25	50	75	100

CALCULATION OF WEIGHT

On days 1, 23, 44 and 57 of the experiment each fish was weighed to the nearest 0.1 g. For each group, the following parameters were calculated:

$$W_t \text{ - } \textit{average individual weight on day } t;$$

$$SGR \textit{ (specific growth rate)} = \frac{(\ln W_t - \ln W_0)}{t}$$

where W_t and W_0 are average individual weights at the start and at the end of the experiment, and t is 57 days.

SGR_L - specific growth rate of the two largest individuals in each group.

SURVIVAL (%)

To exclude the impact of mortalities on the calculation of average weight, after each weighing the fish were sorted in a descending order of weight, and fish with body weight corresponding to body weight of dead fish in other groups were removed and not included in any of the calculations. If, for instance, in group N: 2 one fish with a body weight of 22 g was found dead, one fish of the same weight was removed from each other group. The task was simplified by the fact that only mortality of small fish occurred. At the end of the experiment, ie. after 57 days, 25 fish remained in each group. All calculations were made on the assumption that at the start of the experiment there were 25 fish with an average body weight of 30-32 g in each group, and that no mortalities had occurred.

The differences between average weights were analyzed with ANOVA and standard t-test.

RESULTS

SURVIVAL

The main cause of mortality was aggressive interaction of eels of different sizes in aquaria. On many occasions larger eels chased and bit the smaller ones. The dead fish always had injuries and skin damage. The provision of shelters made from offcuts of

TABLE 2

Growth performance (mean weight ± SD), SGR and SGR_L

Day	Group					
	1 control	2 10% of chicken meal	3 25% of chicken meal	4 50% of chicken meal	5 75% of chicken meal	6 100% of chicken meal
1	32.1 ± 9.3	30.7 ± 10	32 ± 10.8	29.8 ± 12.4	32 ± 8.8	32.2 ± 11.1
23	40.8 ± 12.2[a]	39.7 ± 16.3[a]	41.1 ± 14.1[a]	41.6 ± 18.5[a]	40.8 ± 12.9[a]	44.3 ± 16.6[b]
44	45.7 ± 13.9[a]	44.8 ± 20.4[a]	44.1 ± 17.2[a]	47 ± 21[a]	45.2 ± 15.4[a]	51.7 ± 22.6[b]
57	48.2 ± 15.3[a]	49.8 ± 23.2[a]	48.6 ± 19[a]	52 ± 21.4[b]	49.3 ± 17[a]	53.6 ± 23.9[b]
SGR (%/day)	0.73	0.86	0.75	0.99	0.77	0.91
SGR_L (%/day)	0.29 0.40	1.17 1.04	0.50 0.85	0.55 0.60	0.88 1.00	0.53 1.30
Survival (%)	58	82	70	84	62	50

All means and SD are calculated for N=25

Two means having a common letter are not significantly different at 1% level of significance

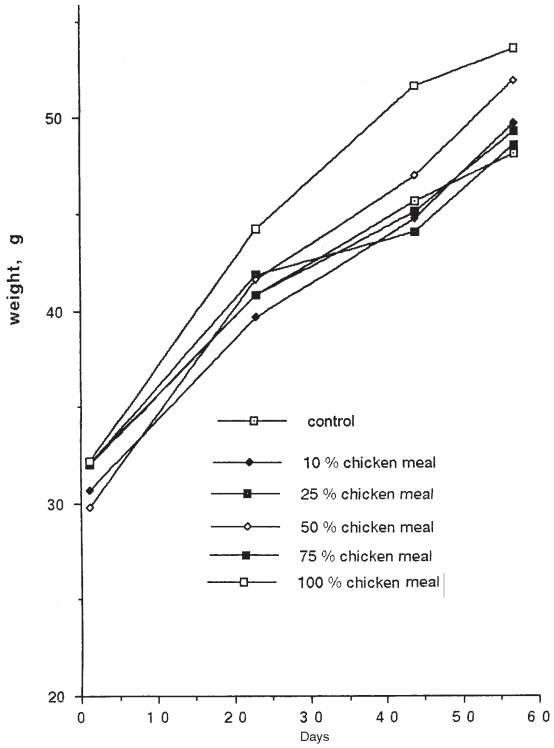

Fig. 1. Growth performance of eels (in g) fed different diets

plastic pipes, decreased the mortality rate, but did not completely eliminate it. Similar behavior was mentioned by other authors for eels reared under low densities.

GROWTH

The results of the experiment are presented in Table 2. During the entire period of rearing, the weight data of all the groups were similar (Fig. 1). However group N:6 (diet of 100% chicken meal) exhibited a significantly better growth performance ($P<0.01$, ANOVA test) than all other groups, and group N:4 (diet of 50% chicken meal) was signiciantly different ($P<0.01$) from the control group. This may be explained by the impact of the one or two largest individuals from these groups, which revealed a relatively high growth performance.

CONCLUSION

Pelleted food prepared using chicken meal may be useful as a substitute for fish meal in the rearing of young eels.

STRESZCZENIE

WYKORZYSTANIE MĄCZKI DROBIOWEJ ZAMIAST MĄCZKI RYBNEJ W ŻYWIENIU MŁODOCIANEGO WĘGORZA

Sześć grup młodocianego węgorza żywiono granulatem, w którym od 10 do 100 % zawartości mączki rybnej zastąpiono mączką drobiową. Analizowano wzrost ryb i ich przeżywalność. W ciągu całego okresu podchowu masa ryb była podobna we wszystkich grupach, lecz węgorze z grupy żywionej granulatem, w którym 100 % mączki rybnej zastąpiono mączką drobiową cechowały się statystycznie istotnie lepszym wzrostem. Stwierdzono, że mączka drobiowa może być użyteczna jako substytut mączki rybnej w paszach dla młodocianego węgorza.