HEMP PROTEIN POWDER FEASIBILITY AS FEED COMPONENT FOR EURASIAN PERCH

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Introduction

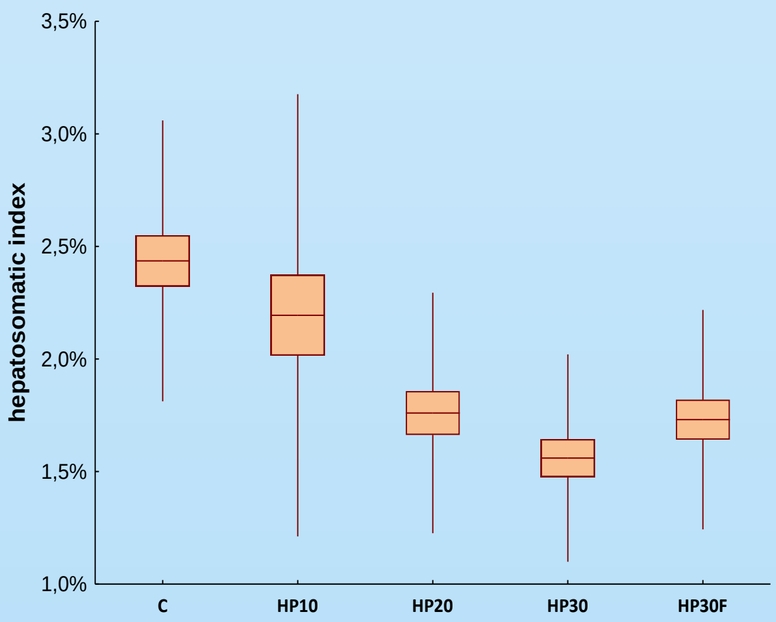
Cultivation of industrial hemp (*Cannabis sativa*) is a rapidly growing branch of agriculture globally with expected annual growth rate of 16.9 % by 2030 (Polaris Market Research 2021). Hemp cultivation area has increased by 75% between 2015 and 2019 in EU and probably will rise further due to hemp environmental benefits like high carbon storage, prevention of soil erosion, biodiversity increasing and low need for pesticides. Hemp fiber is used in textile industry, construction, biofuels production and many new innovative applications. Hemp seeds are source of nutrition for both human and animals. The attempt for use of hemp seed in striped bass feed has given promising results (Sample 2022) . The aim of this study was to test feasibility of hemp protein powder (HPP) as an ingredient of extruded feed for Eurasian perch *Perca fluviatilis* L.

Materials and methods

Experimental feeds. Four extruded feeds containing 0% (control group), 10% (HP10), 20%(HP20) and 30%(HP30) of HPP (50% of crude protein; commercially available diet supplement for human) were prepared. Additionally, the feed containing 30% of hemp and phytase addition (2000 IU per kg) has been extruded (Tab. 1).

Fish and the experiment design. Eurasian perch from pond culture of Polish Inland Fisheries Institute Station in Żabieniec was used for test. Fish of 68.1 g ± 2.7 mean body weight (N=500) were equally distributed to ten fiberglass tanks (0.3 m^3) working in RAS. Tanks were randomly assigned to experimental groups. Each group was present in duplicate. Fish were fed experimental feed appropriate for given group using belt feeders for approximately 10 hours a day for 10 weeks. Then, fish sample (n=15) from each tank was taken for body measurements. Sampled fish were euthanized and dissected. All the viscera and separately the liver were weighted. The remaining fish were weighted to determine final total wet weight. Growth indicators (SGR, FCR, PER, VSI, HIS) were calculated based on collected data.

Statistical analysis. The analysis was done using Statistica 13 software (Statsoft, USA). Shapiro-Wilk test and Levene's test were used to assess data normality and variance homogeneity respectively. As SGR, FCR and PER data revealed lack of variance homogeneity, The Kruskall-Wallis ANOVA was used to test difference significance. For remained data, ANOVA procedure and Tuckey's post hoc test were applied.



Results

The growth of fish was very similar in all experimental groups. No significant differences was found in final body length and weight and specific growth rate.

Hemp content did not influence significantly the feed conversion ratio (FCR)(varied between 2.00 and 3.31) and protein efficiency ratio (PER)(varied between 0.54 and 1.08) although the differences seems rather high. The only significant difference (ANOVA $p<0.05$) was found in the liver weight. HSI was significantly higher in control and HP10 groups(2.44% and 2.19% respectively) when compared to remaining groups (1.56% - 1.76%)(Fig.1).

Generally, it has been noticed that results were slightly better with rising hemp powder addition up to 20%. The worst results were achieved in HP30 group (SGR 0.39, FCR 3.31, PER 0.54), however the best results were achieved in HP30F group (SGR 0.59, FCR2.0, PER 1.08).

Ingredient % of dry matter	Group				
	Control	HP10	HP20	HP30	HP30F
HPP	0	10.0	20.0	30.0	30.0
Fish meal	39.5	32.3	28.2	17.7	17.6
Wheat flour	20.0	18.0	17.0	15.8	15.7
HP300 *	9.5	10.0	4.0	3.5	3.5
Proglobulin **	4.0	4.0	5.0	6.0	6.0
Blood meal	4.0	4.0	4.0	5.4	5.4
Wheat gluten	4.0	4.0	4.6	5.5	5.5
Fish oil	13.3	13.0	12.5	12.5	12.5
Vitamins and minerals	5.7	4.7	4.7	3.7	3.8***
Crude protein	46.0	46.0	46.0	46.0	46.0
Crude fat	18.0	18.0	18.0	18.0	18.0
Fibre	0.7	2.7	4.4	6.3	6.3
Ash	9.1	7.7	7.2	5.4	5.4
NFE	18.8	18.3	17.0	16.9	17.0
Gross Energy (kcal kg^{-1})	5063	4575	4631	4708	4366
RESULTS					
Final wet weight (g)	92.8 ± 17.3	95.1 ± 23.3	97.1 ± 21.9	99.8 ± 20.7	100.3 ± 22.2
Body length (cm)	16.7 ± 1.1	16.8 ± 1.4	16.7 ± 1.3	16.9 ± 1.2	17.0 ± 1.3
VSI (%)	8.3 ± 1.3	8.9 ± 1.7	9.4 ± 2.0	9.5 ± 2.7	9.1 ± 1.4
HSI (%)	**2.4 ± 0.6[a]**	**2.2 ± 1.0[a]**	**1.8 ± 0.5[b]**	**1.6 ± 0.5[b]**	**1.7 ± 0.5[b]**
Fulton's k coefficient	1.2 ± 0.1	1.2 ± 0.1	1.2 ± 0.1	1.2 ± 0.1	1.2 ± 0.1
SGR	0.5 ± 0.1	0.5 ± 0.03	0.5 ± 0.05	0.4 ± 0.11	0.6 ± 0.01
FCR	2.6 ± 0.5	2.4 ± 0.2	2.2 ± 0.2	3.3 ± 1.0	2.0 ± 0.04
PER	0.9 ± 0.2	0.9 ± 0.1	1.0 ± 0.1	0.7 ± 0.2	1.1 ± 0.02

Table 1. Experimental feeds recipes and proximate nutrients composition

* soy protein concentrate

** dried chicken blood plasma, Sonac.

*** including phytase (0.01%) and glycerol (0.1%)

Hemp protein powder addition to feed up to 30% do not influence on growth of Eurasian perch. However, results obtained for HP30 group suggest that higher content of HPP can limit feed conversion and fish growth. The positive effect of phytase is rather unexpected result as it is considered that hemp seed do not contain phytic acid. HPP addition did not cause increased mortality during the experiment and HIS level was significantly lower in groups fed higher level of HPP. Presented results a quite promising, however more intensive study is needed especially to explain the role of phytase.

Table 2. The values (mean ± SD) of the studied indexes of perch at the end of the experimental rearing. Data in rows marked with different letter subscripts indicate statistically significant differences between groups ($p<0.05$).

Acknowledgment

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