NARBONNE VETCH (*VICIA NARBONENSIS*) AS AN ALTERNATIVE RAW MATERIAL TO SUBSTITUTE FISH MEAL IN RAINBOW TROUT (*ONCORHYNCHUS MYKISS*) DIETS

Fernández I[1], Larrán A[1], de Mercado E[2], Alarcón F[3], Cárdaba P[1], Tomás-Almenar C[1]

[1]Center for Aquaculture Research, Agricultural Technological Institute of Castilla and León, Ctra. Arévalo, s/n. 40196 Zamarramala, Segovia, Spain fermonig@itacyl.es
[2]Centro de Pruebas de Porcino, Agricultural Technological Institute of Castilla and León, Ctra Riaza Toro S-N, Hontalbilla 40353, Segovia, Spain
[3]Dpto. Biología y Geología, University of Almería. La Cañada de San Urbano, 04120-Almería, Spain

Introduction

The **sustainable use of natural resources** is a key issue to ensure food safety, nutrition and the **sustainable development of aquaculture**. Nowadays, the future of aquaculture mainly relies on the identification of suitable and alternative raw materials to substitute fishmeal (FM). Although different sources have been evaluated, **FM replacement** is mostly done with protein vegetable sources (mainly soybean meal). Since soybean meal is imported, European aquaculture needs to explore, identify and promote local vegetable proteins sources in order to reduce its dependence of third countries. **Narbonne vetch (*Vicia narbonensis*)** is a legume crop widely available and abundant in Southern European countries, with **seeds containing 20-30% protein** and a **partially balanced amino acid profile**. **Little is known** about the effects of Narbonne vetch inclusion in aquafeeds. The present study **evaluated the effects** of inclusion **of Narbonne vetch in diets for rainbow trout (*Oncorhynchus mykiss*)**.

Experimental design and analyses

After acclimation, fish were randomly allocated into 9 cylindrical fiberglass tanks (500 L; S0) connected to a recirculating aquaculture system. Fish were hand-fed to apparent satiation once a day until a maximum of 3% daily feed intake (DFI) for 63 days with isoproteic (44%) and isolipidic (18%) diets containing graded levels of Narbonne vetch (0, 10 and 30 %; named as CTRL, A10 and A30, respectively) in triplicates.

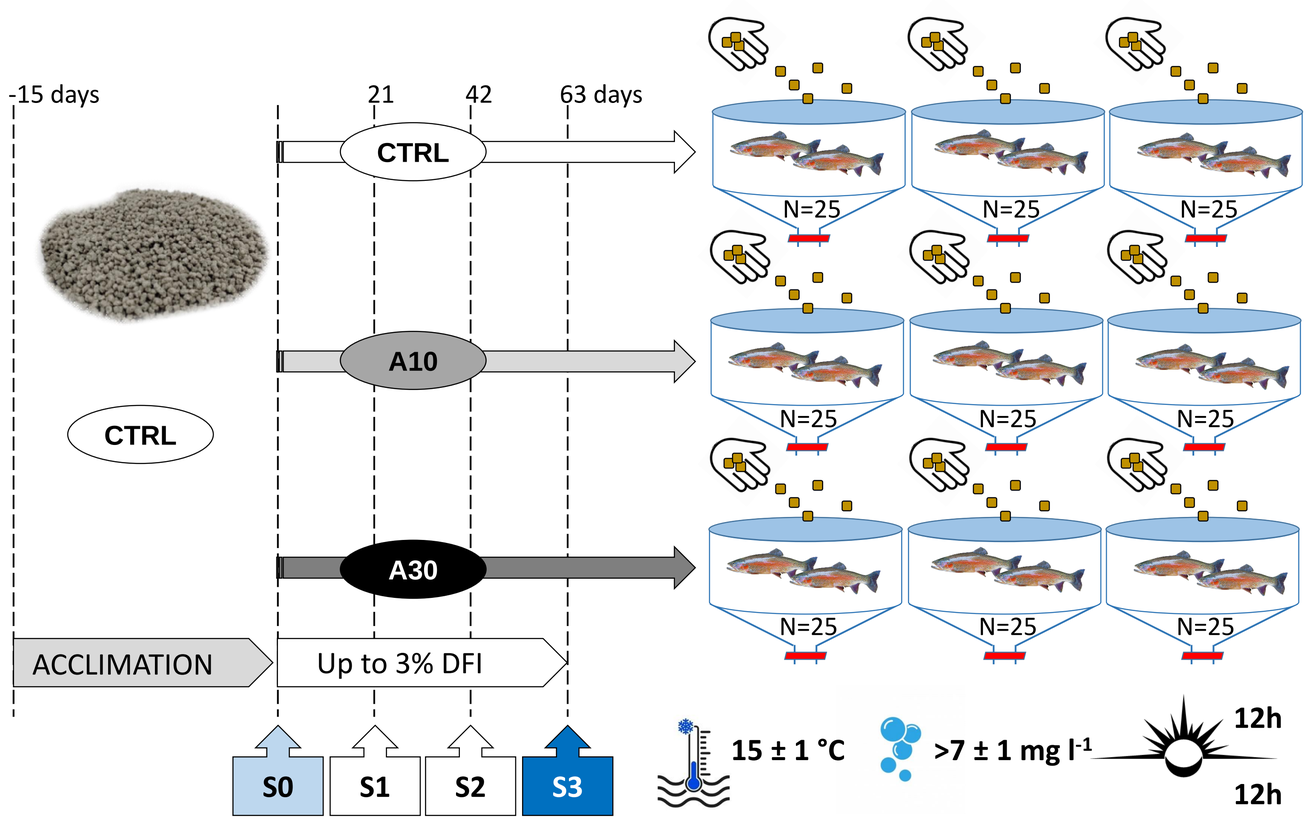

Figure 1. Experimental design of nutritional challenge with 0 (CTRL), 10 (A10) and 30 % (A30) dietary inclusion of Narbonne vetch in rainbow trout diets. *DFI*, daily feed intake; *S*, fish sampling.

Apparent digestibility results

S3

30 % inclusion of Narbonne vetch **reduced the apparent digestibility of crude protein** (ADCprotein; ANOVA, $P < 0.05$).

	CTRL	A10	A30
ADCprotein (%)	93.72 ± 0.39[a]	85.11 ± 3.83[a]	72.21 ± 6.15[b]
Humidity (%)	74.78 ± 0.67	74.99 ± 0.17	75.77 ± 0.63
Protein (%)	71.32 ± 2.30	72.78 ± 0.94	74.86 ± 2.60
Nitrogen (%)	11.41 ± 0.37	11.64 ± 0.15	11.98 ± 0.42

Fatty acid results

S3

30 % inclusion of Narbonne vetch **reduced DHA content in fillet** (ANOVA, $P < 0.05$), but not total polyunsaturated fatty acids.

Fatty acids	CTRL	A10	A30
C20:4n-6 (ARA)	0.2 ± 0.01	0.19 ± 0.01	0.19 ± 0.01
C20:5n-3 (EPA)	7.19 ± 0.23	7.61 ± 0.31	7.36 ± 0.27
C22:6(n-3) (DHA)	0.5 ± 0.02[a]	0.42 ± 0.05[a,b]	0.41 ± 0.03[b]
Saturated	48.64 ± 0.24[a]	45.5 ± 1.11[a]	45.71 ± 0.74[b]
Monounsaturated	31.27 ± 0.5[b]	33.13 ± 0.88[a]	33.2 ± 0.18[a]
Polyunsaturated	20.08 ± 0.34	21.37 ± 1.79	21.09 ± 0.77

Blood plasma results

S3

Inclusion of **Narbonne vetch did not alter the triglyceride, glucose and/or cholesterol plasma** content (not shown; ANOVA, $P > 0.05$).

ANFs *in vitro* results

S0

The **presence of anti-nutritional factors** in Narbonne vetch was previously determined (Alarcón et al., 1999). Narbonne vetch inclusion produced a **28% and 46% inhibition** of rainbow trout **alkaline proteases in A10 and A30 diets** (ANOVA, $P < 0.05$), respectively. In addition, the **γ-glutamyl-S-ethenyl-cysteine** (GEC) value in Narbonne vetch was **2.89 g per 100 g DM**.

Proximate composition results

S0

Narbonne vetch inclusion did not affect feed's protein and lipid content, although it **decreased ash content** (ANOVA, $P < 0.05$).

	N. Vetch	CTRL	A10	A30
Humidity (%)	-	6.51±0.29	6.65±0.21	6.71±0.20
Protein (%)	30.1	43.56±1.73	44.05±0.35	43.23±0.34
Lipid (%)	1.18	18.53±0.25	17.49±0.40	17.83±0.58
Ash (%)	3.26	7.56±0.06[a]	7.08±0.01[b]	6.72±0.04[c]

Growth performance results

S0-S3

A **30 % inclusion** of Narbonne vetch **reduced fish growth,** WG, SGR and PPV, and **increased HSI**; while a **10 % reduced FCR and PER but not fish growth** (ANOVA, $P < 0.05$). Similar results were reported by Buyukcapar et al. (2010) when inclusions of higher than 20 % were tested in tilapia (*Oreochromis niloticus*).

Growth	CTRL	A10	A30
Wi (g)	26.81 ± 0.49	26.03 ± 1.29	27.46 ± 0.24
Wf (g)	137.24 ± 4.16[a]	125.04 ± 10.27[a]	96.33 ± 1.03[b]
WG (%)	401.18 ± 7.68[a]	380.16 ± 24.51[a]	250.83 ± 2.64[b]
SGR (% day^{-1})	2.59 ± 0.03[a]	2.49 ± 0.08[a]	1.99 ± 0.01[b]
DFI (%)	1.62 ± 0.03[a]	1.69 ± 0.02[b]	1.82 ± 0.01[c]
FCR	0.77 ± 0.01[a]	0.81 ± 0.02[b]	1.03 ± 0.01[c]
Use of protein			
PER*	2.98 ± 0.05[a]	2.79 ± 0.08[b]	2.23 ± 0.05[c]
PPV**	0.48 ± 0.01[a]	0.46 ± 0.01[a]	0.36 ± 0.01[b]
Biometries			
CF (g cm^{-3})	1.32 ± 0.04	1.32 ± 0.02	1.35 ± 0.02
HSI (%)	1.06 ± 0.09[a]	1.04 ± 0.09[a]	1.27 ± 0.09[b]
VSI (%)	11.11 ± 0.91	10.34 ± 0.26	10.36 ± 1.41

Conclusions

- **Narbonne vetch** presented a quite **amount of ANFs** inhibiting the activity of alkaline proteases
- The inclusion of Narbonne vetch **reduced the amount of minerals** (ash) in fish feed
- **A 30 % Narbonne vetch inclusion** in fish diets **affected rainbow trout growth and physiology** (increased HSI)
- 30 % of inclusion **decreased the ADCprotein** in fish fillet
- Narbonne vetch inclusion also **affected the fatty acids profile of fish fillet**, decreasing the content of DHA and increasing the content of monounstaurated fatty acids
- Narbonne vetch in **low inclusions (< 10 %) can be used as alternative** for soy bean meal
- In future studies the inclusion of different **varieties and the pre-treatment** of Narbonne vetch seeds will be explored

References

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- Buyukcapar H.M., et al., 2010. J Appl Anim Res 37: 253-256.

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