L'utilisation d'Urtica Dioïca en aquaculture :

Une approche durable pour la santé et la croissance des poissons

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Introduction

L'aquaculture occupe une place essentielle dans le système alimentaire mondial, représentant une source majeure de protéines animales. Cependant, le développement rapide de ce secteur s'accompagne de difficultés croissantes, notamment la prévalence accrue des maladies infectieuses des poissons. Ces maladies sont souvent provoquées par des agents pathogènes de types bactériens.

Dans ce contexte, la recherche de solutions naturelles et durables pour renforcer la santé des poissons tout en réduisant l'utilisation d'antibiotiques est devenue une priorité pour répondre à la demande des consommateurs. Parmi les alternatives prometteuses AGRORTIE vous propose l'utilisation d'Urtica Dioïca, la grande ortie,

De nombreuses études récentes ont mis en évidence les effets bénéfiques de l'incorporation d'ortie dans l'alimentation des poissons. Les résultats montrent de façon significative l'amélioration des paramètres de croissance, de l'immunité, des indices hémato-biochimiques ainsi qu'une amélioration significative du gain de poids, du taux de croissance spécifique et du taux de conversion alimentaire.

Nous vous présentons diverses publications qui ont exploré de manière approfondie l'effet de la supplémentation alimentaire en ortie (U. Dioïca).

Les résultats de ces études confirment le potentiel remarquable d'Urtica Dioïca. Les bénéfices observés, tels qu'un pourcentage de survie accru contre certains agents pathogènes, des performances de croissance et de santé, mettent en lumière la capacité de l'ortie.

Les atouts nutritionnels de l’ortie

L’ortie est également très riche en minéraux et plus particulièrement en Ca, P, Fe, Si et Mg. L'ortie est considérée comme la plante par excellence pour lutter contre l'anémie.

Elle enferme de nombreuses vitamines telles que : A, B2, B5, B9, C, E, K.

Enfin, il faut souligner sa haute teneur en chlorophylle et caroténoïdes (violaxanthine, xanthophylles, zéaxanthine, luthéine), en histamine

L’ortie est quantitativement et qualitativement l’un des végétaux les plus riches en protéines complètes. L’ortie contient en effet 18 acides aminés dont plusieurs essentiels ce qui en fait une protéine parfaitement assimilable par l’organisme au même titre qu’une protéine animale.

Bhaskar Mani Adhikari a comparé la composition de l’ortie avec celle du blé et de l’orge.

Paramètres	Farine de blé	Farine d'orge	Poudre d'ortie
Humidité (%)	12,37 ± 0,25	12,2 ± 0,19	7,04 ± 0,77
Protéine brute (%, db)	10,6 ± 0,23	11,84 ± 0,09	33,77 ± 0,35
Fibres brutes (%, db)	0,65 ± 0,13	1,03 ± 0,08	9,08 ± 0,14
Matières grasses brutes (%, db)	1,68 ± 0,23	1,73 ± 0,67	3,55 ± 0,06

Paramètres	Farine de blé	Farine d'orge	Poudre d'ortie
Cendres totales (%, db)	0,56 ± 0,07	3,6 ± 0,08	16,21 ± 0,54
Glucides (%, db)	86,51 ± 0,27	81,8 ± 0,08	37,39 ± 0,72
Calcium (mg/100 g)	18,94 ± 0,08	17,51 ± 0,26	168,77 ± 1,47
Fer (mg/100 g)	3,37 ± 0,29	3,63 ± 0,11	227,89 ± 0,21

- db, base sèche. ND, non déterminé.

Analyse de la farine de blé, de la farine d'orge et de la poudre d'ortie

Paramètres	Farine de blé	Farine d'orge	Poudre d'ortie
Teneur en tannins (% tel quel)	ND	0,53 ± 0,03	0,93 ± 0,01
Polyphénols totaux (mg GAE/g, db)	1,31 ± 0,01	1,76 ± 0,01	128,75 ± 0,21
Activité antioxydante (inhibition du DPPH, % tel quel)	23,72 ± 0,45	28,64 ± 0,03	66,3 ± 0,12
Caroténoïdes (μ g/g, db)	320,05 ± 0,08	382,3 ± 0,56	3496,67 ± 0,56
Valeur calorifique (kcal/100 g)	381,93 ± 0,05	369,68 ± 0,84	307,24 ± 0,13

	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Apports (mg/g MAT)	Score chimique	Score chimique	Score chimique	Score chimique	Score chimique	Score chimique
AA	Rainbow trout	Atlantic salmon	Coho salmon	Cherry salmon	Channel catfish	MOYENNE	Ortie	Rainbow trout	Atlantic salmon	Coho salmon	Cherry salmon	Channel catfish	MOYENNE
Histidine	29,6	30,2	29,9	23,9	21,7	27,06	26,87	0,908	0,890	1,113	0,889	1,238	0,993
Ile	43,4	44,1	37	39,6	42,9	41,4	36,03	0,830	0,817	1,027	1,099	0,840	0,870
Leucine	75,9	77,2	74,9	75,4	74	75,48	74,95	0,987	0,971	0,999	1,006	1,013	0,993
Lysine	84,9	92,8	86,4	88,1	85,1	87,46	59,00	0,695	0,636	1,464	1,493	0,693	0,675
Met. + Cys.	36,8	27,8	47,6	44,8	37,8	38,96	23,39	0,636	0,841	2,035	1,915	0,619	0,600
Phe+Tyr	77,6	78,6	75,8	82,1	74,2	77,66	75,30	0,970	0,958	1,007	1,090	1,015	0,970
Thr	47,6	49,5	51,1	46,3	44,1	47,72	41,39	0,870	0,836	1,235	1,119	0,939	0,867
Trp	9,3	9,3	14	8,3	7,8	9,74	13,72	1,475	1,475	1,021	0,605	1,758	1,408
Val	50,9	50,9	43,2	48,5	51,5	49	46,12	0,906	0,906	0,937	1,052	0,896	0,941

Tableau 1 : Besoins en AA, apports d'*Urtica dioica* et score chimique d' *Urtica dioica* pour différentes espèc de poissons (Source : *Amino acids in animal nutrition*, 2ème édition)

	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Besoins AA (gAAI /1000g AA)	Apports (mg/g MAT)	Score chimique	Score chimique	Score chimique	Score chimique	Score chimique	Score chimique
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Leucine	75,9	77,2	74,9	75,4	74	75,48	74,95	0,987	0,971	0,999	1,006	1,013	0,993
Lysine	84,9	92,8	86,4	88,1	85,1	87,46	59,00	0,695	0,636	1,464	1,493	0,693	0,675
Met. + Cys.	36,8	27,8	47,6	44,8	37,8	38,96	23,39	0,636	0,841	2,035	1,915	0,619	0,600
Phe+Tyr	77,6	78,6	75,8	82,1	74,2	77,66	75,30	0,970	0,958	1,007	1,090	1,015	0,970
Thr	47,6	49,5	51,1	46,3	44,1	47,72	41,39	0,870	0,836	1,235	1,119	0,939	0,867
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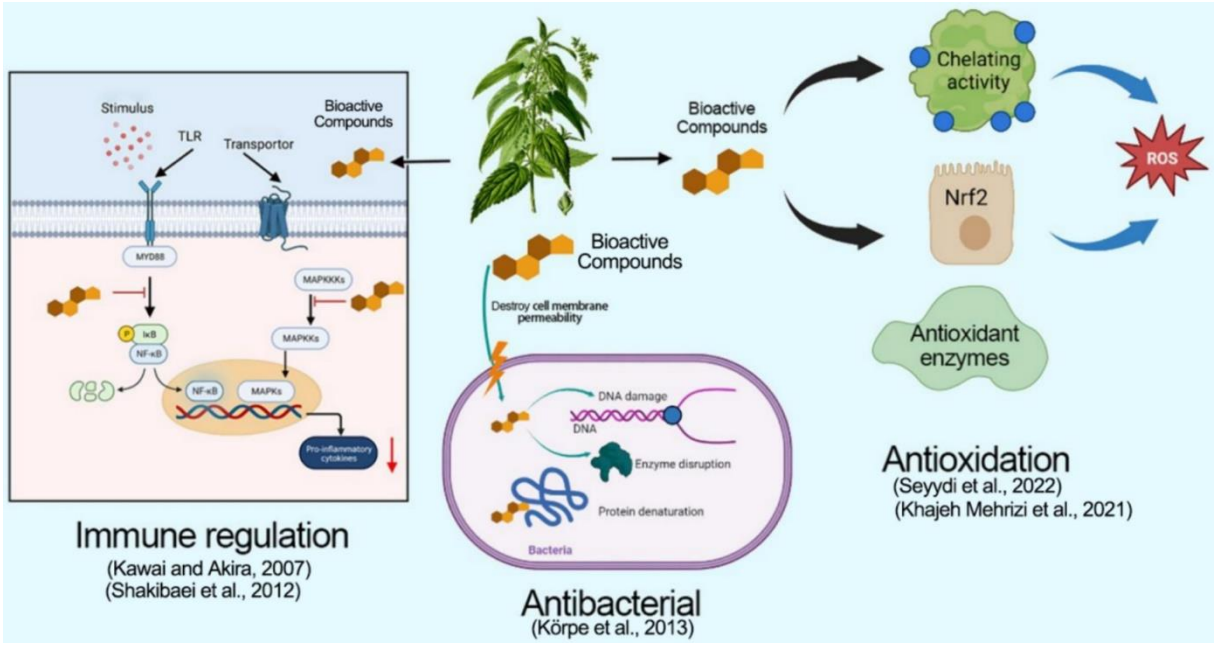
Les vertus de l’ortie pour les poissons.

La fonction biologique des Urtica spp. et son application chez la volaille, les poissons et le bétail



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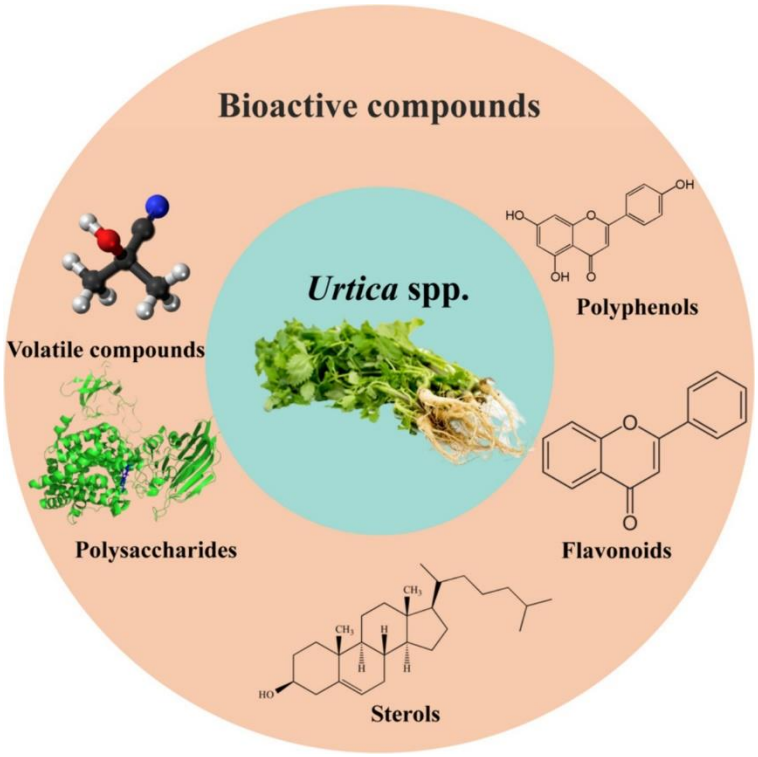
Huan Leng2,3*Jize Zhang Jize Zhang4* 2024

https://www.frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1430362/full



Propriétés bioactives et effets bénéfiques de l'ortie

Les études mettent en exergue le potentiel de l'ortie en tant que complément nutritionnel précieux pour augmenter la réaction immunologique des poissons, accroitre le taux de survie et réduire le stress.

Charles C. Ngug a réalisé une expérimentation avec Victoria Labeo (*Labeo victorianus*) infectés avec *Aeromonas hydrophila*. Il a démontré qu'avec une incorporation de 5% d'U. Dioïca il a amélioré les paramètres biochimiques, hématologiques et immunologiques. Le glucose, les triglycérides et le cholestérol ont diminué tandis que les protéines totales et l'albumine dans le poisson ont augmenté avec l'inclusion alimentaire croissante de U. Dioïca. Parmi les paramètres d'hématologie : nombre de globules rouges (GR), nombre de globules blancs (CBM), hématocrite (Htc), hémoglobine cellulaire moyenne (HME), concentration moyenne d'hémoglobine dans les cellules (MCHC) et les nutrophiles ont augmenté.

Javed Ahmed Ujan a réalisé un essai avec des alevins Labeo rohita recevant un régime alimentaire enrichi à raison de 5% d'ortie durant 60 jours puis subissant une injection intrapéritonéale de bactéries (Aeromonas hydrophila). Il a été observé un pourcentage relatif de survie (RPS) supérieur dans le lot enrichi à 5%. Les performances de croissance, y compris « le gain de poids (WG), le taux de croissance spécifique (SGR), le taux de conversion alimentaire (FCR) et le taux d'efficacité alimentaire (FER) », étaient nettement plus élevées dans le groupe de 5 %. Les

valeurs hématologiques des globules blancs, de l'hématocrite et de l'hémoglobine ont révélé des niveaux plus élevés avec un régime enrichi. La supplémentation alimentaire en ortie a réduit la concentration de cholestérol sérique et de glucose, tandis qu'elle a augmenté l'albumine, la globuline et la protéine totale dans le sang des poissons.

Reza Saeidi As a démontré qu'un ajout d'U. Dioïca de 3 % à la ration a entraîné une amélioration significative du gain de poids, du taux de croissance spécifique et du taux de conversion alimentaire par rapport aux autres groupes ($P < 0,05$). Les réponses hématologiques, notamment : l'hématocrite (Htc), l'hémoglobine (Hb), les populations de lymphocytes et de neutrophiles, ont augmenté significativement chez les poissons nourris à 3 % d'ortie. La mortalité cumulée des truites arc-en-ciel soumises à Y. ruckeri infectieuses a montré des niveaux de mortalité relativement faibles dans tous les groupes supplémentés, le plus bas étant chez les poissons nourris avec 3 % d'ortie.

Sabri Ünal Kastamonu a étudié la résistance aux maladies contre Aeromonas hydrophila chez la truite arc-en-ciel (Oncorhynchus mykiss) avec un ajout d'ortie [0 (témoin), 0,1 et 0,5 g kg- 1 d'aliment]. Après 30 jours d'essai d'alimentation, la truite arc-en-ciel a été confrontée à un pathogène bactérien, A. hydrophila. Les résultats ont montré que le poids final et le taux de croissance spécifique des poissons étaient plus élevés dans tous les groupes traités avec l'ortie ($P < 0,05$).La truite arc-en-ciel traitée avec 0,1 et 0,5 kg d'extrait d'ortie lorsqu'elle était confrontée à A. hydrophila avait le plus haut taux de survie.

Zibandeh Mehrabi a réalisé un essai sur un total de 264 truites arc-en-ciel juvéniles (10,72 ± 0,55 g). De la poudre d'ortie a été ajoutée à l'alimentation des poissons à trois doses, 0,5, 1 et 1,5 % servant de traitements. À la fin de la période d'alimentation de 8 semaines, les poissons ont été exposés à Saprolegnia parasitica pendant 3 semaines. Les résultats ont montré que tous les traitements alimentés avec des régimes à base d'ortie présentaient des augmentations significatives du gain de poids et du SGR, et une diminution du FCR par rapport au témoin et avaient entraîné des augmentations significatives des indices sanguins et de l'immunité non spécifique. De plus, les poissons nourris avec 0,5 % d'ortie une réduction significative du taux de mortalité.

Charles C Ngugi a étudié les effets de l'administration alimentaire d'ortie (Urtica Dioïca chez les juvéniles et adultes Victoria Labeo (Labeo victorianus) infectés par Aeromonas hydrophila. Les poissons ont été divisés en 4 groupes et nourris pendant 4 et 16 semaines avec 0 %, 1 %, 2 % et 5 % d'U. dioica incorporés dans l'alimentation.

L'utilisation d'U. DioÏca dans l'alimentation a entraîné une amélioration des paramètres biochimiques, hématologiques et immunologiques. Parmi les paramètres biochimiques ; le cortisol plasmatique, le glucose, les triglycérides et le cholestérol ont diminué tandis que les protéines totales et l'albumine chez les poissons ont augmenté avec l'inclusion alimentaire croissante d'U. Dioïca. Parmi les paramètres hématologiques : le nombre de globules rouges (RBC), le nombre de globules blancs (WBC), l'hématocrite (Htc), l'hémoglobine cellulaire moyenne (MCH), la concentration moyenne en hémoglobine cellulaire (MCHC) et les nétrophiles ont augmenté avec l'augmentation des niveaux d'inclusion alimentaire d'U. Dioïca. Les immunoglobulines sériques, l'activité lysozyme et l'éclatement respiratoire étaient les principaux paramètres immunologiques mesurés chez les L. victorianus adultes et juvéniles et ils ont tous augmenté avec l'augmentation de l'inclusion végétale d'U. Dioïca dans l'alimentation.

L'incorporation alimentaire d'U. Dioïca à 5 % a montré un pourcentage relatif de survie significativement plus élevé (jusqu'à 95 %) contre A. hydrophila.

Binai a démontré que qu'en utilisant un complément d'ortie à des doses de 6 et 12%, il y a une amélioration des paramètres hémato-biochimiques et de la fonction immunitaire des bélugas juvéniles (Huso huso). Après 8 semaines, les poissons traités à l'ortie ont montré une augmentation significative des taux de neutrophiles et d'Hb par rapport au témoin et que les valeurs de RBC et d'Hct ont augmenté significativement.

Reza Saeidi Asl a constaté qu'une supplémentation alimentaire de 3% en ortie (Urtica Dioïca) améliorait les performances de croissance, le mucus cutané, la réponse immunitaire et la résistance aux maladies de la truite arc-en-ciel (Oncorhynchus mykiss) : une activité antagoniste a été améliorée contre plusieurs agents pathogènes bactériens (Streptococcus iniae, Yersinia ruckeri, Vibrio anguillarum et Lactococcus garviae). Après 8 semaines d'alimentation, l'ajout d'U. Dioïca à raison de 3 % a entraîné une amélioration significative du gain de poids, du taux de croissance spécifique et du taux de conversion alimentaire.

Selon Mahyar Zare les additifs naturels tels que l'ortie pourraient représenter un substitut écologique et durable aux hormones, aux antibiotiques et aux médicaments chimiques pour améliorer les performances de croissance, le système immunitaire et la résistance aux agents pathogènes grâce à des composés actifs, notamment des alcaloïdes, des flavonoïdes, des composés phénoliques, des terpénoïdes, des pigments, des minéraux et des huiles essentielles.

Conclusion

L'ensemble des études examinées démontre le fort potentiel de l'ortie (Urtica Dioïca) comme complément alimentaire dans l'aquaculture. L'incorporation d'Urtica Dioïca dans l'alimentation des poissons apparaît comme une approche innovante et durable pour améliorer la santé et les performances des poissons en aquaculture. De nombreuses études ont mis en évidence ses effets bénéfiques, notamment en renforçant l'immunité, en améliorant les paramètres de croissance et en augmentant la résistance aux infections bactériennes ainsi que le taux de survie. L'ortie agit non seulement comme un complément nutritionnel riche en composés bioactifs, mais aussi comme un agent naturel contribuant à réduire l'utilisation des antibiotiques, garantissant à la fois la rentabilité des exploitations et la qualité des poissons tout en étant plus respectueuse de l'environnement. Ainsi, l'ortie se présente comme un atout prometteur pour une aquaculture plus saine et plus écologique.

Targeting fish spoilers Pseudomonas and Shewanella with oregano and nettle extracts - 2020

Meta Sterniša [1], Franz Bucar [2], Olaf Kunert [3], Sonja Smole Možina [4]

To control Pseudomonas and Shewanella as important psychrotrophic spoilage bacteria in fish meat, we used ethanolic extracts of oregano (Origanum vulgare subsp. vulgare) and nettle (Urtica dioica), with phytochemical characterisation of the extracts and their bioactive compounds. Liquid chromatography coupled with photodiode array detection and electrospray ionisation-mass spectrometry was used for qualitative compositional determination of the extracts. Four main compounds were identified in the oregano extract, with rosmarinic acid the most abundant, followed by three glycosylated phenolics, one of which is reported for the first time in O. vulgare: 4'-O-β-d-glucopyranosyl-3',4'-dihydroxybenzyl-4-hydroxybenzoate. Six main compounds were identified in the nettle extract, as caffeoylmalic acid and five

flavonoid glycosides. These oregano and nettle ethanolic extracts showed in-vitro antimicrobial activities against selected Pseudomonas and Shewanella strains in broth and fish meat homogenate when evaluated at two inoculum concentrations. The antimicrobial activities were more pronounced for the nettle extract at the lower inoculum concentration, and for both the Shewanella strains. Growth inhibition in the fish meat homogenate was evaluated at 3.13 mg/mL and 1.56 mg/mL at 5 °C. Again, the nettle extract showed greater antimicrobial activity, which was seen as the lowest maximum growth rate, followed by the oregano extract, which was inhibitory only at 3.13 mg/mL. Finally, the extracts were applied to fish meat that was then stored at 5 °C for 9 days. Evaluation here was for the counts of the mesophilic, psychrotrophic, Pseudomonas and H_2S producers. These confirmed the better antimicrobial effects of the nettle extract, especially against the H_2S-producing bacteria, which included Shewanella. Both of the extracts were rich in glycosides of flavonoids and phenolic acids. The enzymatic activities of the Pseudomonas and Shewanella spoilage bacteria and their actions on the phenolic glycosides from natural sources will be further investigated.

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Nettle (Urtica dioica) supplementation: impact on growth, hematology, immune response, and resilience to Aeromonas hydrophila in Labeo rohita fingerlings

- November 2024

Javed Ahmed Ujjan, Shah Abdul Latif University, **Asif Raza**, **Syed Sikandar Habib**,

Rimsha Athar

The significance of plant-derived products in aquaculture lies in their potential to offer sustainable alternatives, promoting eco-friendly practices. This study investigated the impact of nettle (Urtica dioica) leaves powder on the growth efficiency, hemato-biochemical variables and non-specific immune system of rohu, Labeo rohita fingerlings. To achieve this objective, sample average weight (5.23 ± 0.34 g) were categorized into four groups, namely control, T1, T2 and T3 in triplicate and administered diets fortified with nettle in amounts of 0, 1, 3 and 5% respectively for a duration of 60 days. After 60 days of fortified diet, the fish underwent intraperitoneal injection with bacteria (Aeromonas hydrophila), and subsequent relative percentage survival (RPS) was observed. The growth performance, including “weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR) and feed efficiency ratio (FER)”, were notably higher in the T3 group (5%) than in others. The hematological values of White blood cell, hematocrit, and hemoglobin revealed higher levels with a fortified diet. The dietary supplementation of nettle reduced serum cholesterol and glucose concentration, whereas it increased albumin, globulin, and total protein in the fish blood. Enhancements in lysozyme and myeloperoxidase activity were observed in the intervention groups with feed containing nettle supplementation. The nettle diet at a 5% concentration demonstrated a higher RPS

than the others following injection with A. hydrophila. The findings indicate the potential of nettle as a valuable nutritional supplement for increasing fish immunological reaction and bolstering pathogen resistance.

Aquac Nutr

. 2023 Feb 21:2023:8261473.
doi: 10.1155/2023/8261473.

Nettle (*Urtica dioica*) Additive as a Growth Promoter and Immune Stimulator in Fish

Mahyar Zare [1], Noah Esmaeili [2], Simona Paolacci [3], Vlastimil Stejskal [1] eCollection 2023.

Aquaculture will become an important food production sector for humans in the coming decades. However, disease outbreaks can be considered a significant obstacle to continually developing aquaculture. Plant powders and extracts are natural feed additives that, due to their bioactive compounds, including phenolic compounds, proteins, vitamins, and minerals, have antistress, antiviral, antibacterial, and antifungal effects on fish. One of these herbs is nettle (*Urtica dioica*), which has a long history of being used in traditional medicine. While it has been widely investigated in mammalian medicine, few studies have been done on aquaculture species. The positive effect of this herb on the growth performance, hematology, blood biochemistry, and immune system of fish species has been observed. When fish were exposed to pathogens, nettle-fed fish showed a higher survival rate and less stress than controls. Therefore, this literature review is aimed at reviewing the use of this herb in fish diets and its impacts on growth performance, hematology, blood biochemistry, liver enzymes, immune system stimulation, and challenges with pathogens.

Effects of oyster mushroom (*Pleurotus ostreatus*) and nettle (*Urtica dioica*) methanolic extracts on immune responses and resistance to *Aeromonas hydrophila* in rainbow trout (*Oncorhynchus mykiss*).

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In this study, immunostimulant effects of the methanolic extracts of oyster mushroom (*Pleurotus ostreatus*) and nettle (*Urtica dioica*), and disease resistance against *Aeromonas hydrophila* in rainbow trout (*Oncorhynchus mykiss*) were investigated. Three different concentrations of extracts [0 (Control), 0.1 and 0.5 g kg^{-1} of feed] were individually mixed with the basal diet and fed to rainbow trout (10.28±0.1 g) for a 30-day period. After 30 days feeding trial, rainbow trout was challenged with bacterial pathogen, *A. hydrophila*. Results showed that final fish weight and specific growth rate were higher in all treated groups compared to control group (P<0.05) with no differences among treated groups (P>0.05). Both in oyster mushroom and nettle extract administered groups, feed conversion ratio was lower than in control and the lowest level was in 0.1 g kg^{-1} oyster mushroom group. All measured immune parameters were affected by the dietary intake of oyster mushroom and nettle extract (P<0.05). Nitroblue tetrazolium (NBT) activity was found higher in all the treated groups compared to control. Phagocytic activity was also increased in all treatment groups. However, the highest level of phagocytic activity was observed in nettle groups with no differences between two doses. Lysozyme activity was higher in all administered groups compared to control. However, the highest level of lysozyme activity was observed in 0.5 g kg^{-1} nettle group. Myeloperoxidase activity was elevated in treated groups compared to control with the highest levels in nettle group. Moreover, rainbow trout treated with 0.1 and 0.5 kg^{-1} nettle extract when challenged with *A. hydrophila* had the highest survival rate. No differences in survival were exhibited between control and oyster mushroom group. These results indicated an immunostimulatory and antimicrobial effects of oyster mushroom and nettle extracts in rainbow trout. However, cost-effectiveness of nettle places its better acceptance and application as an immunostimulant for rainbow trout. Statement of relevance: This study was related with non-specific immune system of fish and effects of different medicinal plant or mushroom on it. The main aim was to investigate and find new and cost-effective immunostimulant for fish, especially for rainbow trout. It was also aimed to find a disease blocker for rainbow trout especially against *A. hydrophila*.

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Immunity and growth improvement of rainbow trout (Oncorhynchus mykiss) fed dietary nettle (Urtica dioica) against experimental challenge with Saprolegnia parasitica

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In this study, effects of nettle (Urtica dioica) on growth, immunity, and gene expressions were examined in rainbow trout after an 8-week feeding period. A total of 264 juvenile rainbow trout (10.72 ± 0.55 g) were selected and stocked randomly in 12 aquaria. Nettle powder was added to the fish feed at three doses, 0.5,1 and 1.5% served as treatments. At the end of 8-week feeding period, the fish were exposed to Saprolegnia parasitica for 3 weeks. Results showed that all treatments fed with nettle diets exhibited significant increases in weight gain and SGR, and decreased FCR compared to the control. Feeding the fish with dietary nettle resulted in significant rises in blood indices and non-specific immunity in comparison with the control. Furthermore, fish fed 0.5% of dietary nettle showed significantly increased expressions of TNF-α, IL-1b, IL-6 and IL-8 genes following 8 weeks of feeding. A significant reduction in mortality rate was observed in the fish treated with 0.5% of nettle compared to the control following challenging with S. parasitica. Our observations indicate that the use of 0.5% nettle powder in rainbow trout diet can improve growth and immunity parameters as well as fish resistance against S. parasitica contamination.

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Effects of dietary administration of stinging nettle (Urtica dioica) on the growth performance, biochemical, hematological and immunological

parameters in juvenile and adult Victoria Labeo (Labeo victorianus) challenged with Aeromonas hydrophila

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We investigated effects of dietary administration of stinging nettle (Urtica dioica) on growth performance, biochemical, hematological and immunological parameters in juvenile and adult Victoria Labeo (Labeo victorianus) against Aeromonas hydrophila. Fish were divided into 4 groups and fed for 4 and 16 weeks with 0%, 1%, 2% and 5% of U. dioica incorporated into the diet. Use of U. dioica in the diet resulted in improved biochemical, hematological and immunological parameters. Among the biochemical parameters; plasma cortisol, glucose, triglyceride and cholesterol decreased while total protein and albumin in fish increased with increasing dietary inclusion of U. dioica. Among the haematology parameters: red blood cell (RBC), white blood cell (WBC) counts, haematocrit (Htc), mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC) and netrophiles increased with increasing dietary inclusion levels of U. dioica, some depending on the fish age. Serum immunoglobulins, lysozyme activity and respiratory burst were the main immunological parameters in the adult and juvenile L. victorianus measured and they all increased with increasing herbal inclusion of U. dioica in the diet. Dietary incorporation of U. dioica at 5% showed significantly higher relative percentage survival (up to 95%) against A. hydrophila. The current results demonstrate that using U. dioica can stimulate fish immunity and make L. victorianus more resistant to bacterial infection (A. hydrophila).

Targeting fish spoilers Pseudomonas and Shewanella with oregano and nettle extracts

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To control Pseudomonas and Shewanella as important psychrotrophic spoilage bacteria in fish meat, we used ethanolic extracts of oregano (Origanum vulgare

subsp. vulgare) and nettle (Urtica dioica), with phytochemical characterisation of the extracts and their bioactive compounds. Liquid chromatography coupled with photodiode array detection and electrospray ionisation-mass spectrometry was used for qualitative compositional determination of the extracts. Four main compounds were identified in the oregano extract, with rosmarinic acid the most abundant, followed by three glycosylated phenolics, one of which is reported for the first time in O. vulgare: 4'-O-β-d-glucopyranosyl-3',4'-dihydroxybenzyl-4-hydroxybenzoate. Six main compounds were identified in the nettle extract, as caffeoylmalic acid and five flavonoid glycosides. These oregano and nettle ethanolic extracts showed in-vitro antimicrobial activities against selected Pseudomonas and Shewanella strains in broth and fish meat homogenate when evaluated at two inoculum concentrations. The antimicrobial activities were more pronounced for the nettle extract at the lower inoculum concentration, and for both the Shewanella strains. Growth inhibition in the fish meat homogenate was evaluated at 3.13 mg/mL and 1.56 mg/mL at 5 °C. Again, the nettle extract showed greater antimicrobial activity, which was seen as the lowest maximum growth rate, followed by the oregano extract, which was inhibitory only at 3.13 mg/mL. Finally, the extracts were applied to fish meat that was then stored at 5 °C for 9 days. Evaluation here was for the counts of the mesophilic, psychrotrophic, Pseudomonas and H_2S producers. These confirmed the better antimicrobial effects of the nettle extract, especially against the H_2S-producing bacteria, which included Shewanella. Both of the extracts were rich in glycosides of flavonoids and phenolic acids. The enzymatic activities of the Pseudomonas and Shewanella spoilage bacteria and their actions on the phenolic glycosides from natural sources will be further investigated.

Biochemical and hemato-immunological parameters in juvenile beluga (Huso huso) following the diet supplemented with nettle (Urtica dioica)

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The present study investigated the effects of different dietary nettle (Urtica dioica) levels on biochemical, hematological and immunological parameters in beluga (Huso huso). Fish were divided into 4 groups before being fed for 8 weeks with 0%, 3%, 6% and 12% of nettle. The blood samples were collected on week 4 and 8. The use of nettle did not significantly change the mean cell volume, mean cell haemoglobin,

lymphocytes, eosinophils, albumin, glucose, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase and lysozyme activity on week 4 and 8. After 4 weeks, the total red blood cell (RBC) and hematocrit (Ht) showed a significant increase in 12% nettle group compared to the 3% nettle and control groups but haemoglobin (Hb) had a significant change in 12% nettle compared to the control. At the same time was not found a significant change in the mean cell haemoglobin concentration (MCHC), total white blood cell (WBC), neutrophils, respiratory burst activity (RB), total immunoglobulin (Ig) and total protein (TP), triglyceride (Tri) and cholesterol (Chol). After 8 weeks, the fish treated with nettle exhibited significantly increase in neutrophil and Hb levels compared to the control and between treatment groups, 12% nettle group shown the highest Hb while RBC and Hct values significantly rose in fish fed by 12% compared to the control. Supplementing 6% and 12% nettle increased the WBC and MCHC compared to the other groups. The group fed 12% showed a highly significant difference in RB, TP and Ig after 8 weeks. However, Tri and Chol were significantly decreased in the juvenile beluga fed by the 6% and 12% nettle diet compared to the other groups. The results suggest that by using this herb there will be an improvement in hemato-biochemical parameters and immune function of juvenile beluga.

Use of lupin, Lupinus perennis, mango, Mangifera indica, and stinging nettle, Urtica dioica, as feed additives to prevent Aeromonas hydrophila infection in rainbow trout, Oncorhynchus mykiss (Walbaum)

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Feeding rainbow trout, Oncorhynchus mykiss (Walbaum), with 1% lupin, Lupinus perennis, mango, Mangifera indica, or stinging nettle, Urtica dioica, for 14 days led to reductions in mortality after challenge with Aeromonas hydrophila. In addition, there was significant enhancement in serum bactericidal activity, respiratory burst and lysozyme activity in the treatment groups compared to the controls. Use of lupin and mango led to the highest number of red blood and white blood cells in recipient fish, with use of stinging nettle leading to the highest haematocrit and haemoglobin values; the highest value of mean corpuscular volume and haemoglobin was in the control groups and those fed with stinging nettle.

Immunological responses and disease resistance of rainbow trout (Oncorhynchus

mykiss) juveniles following dietary administration of stinging nettle (Urtica dioica)

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The present study investigated the effects of dietary supplementation of stinging nettle (Urtica dioica) on growth performance, skin mucus, immune response and disease resistance of rainbow trout (Oncorhynchus mykiss) fed with diets supplemented with U. dioica at 0, 1, 2 and 3%. After 8 weeks of feeding, the addition of U. dioica at 3% level resulted in improved weight gain, specific growth rate and feed conversion ratio significantly when compared to the other groups ($P < 0.05$). Hematological responses including: hematocrit (Htc), hemoglobin (Hb), lymphocyte and neutrophil populations enhanced significantly in fish fed 3% of stinging nettle when measured after 4 weeks; while, total red blood cells, white blood, Htc, Hb, lymphocyte and neutrophil populations significantly increased after 8 weeks in the same group ($P < 0.05$). Total serum protein and glucose contents increased significantly in fish fed stinging nettle at 3% when compared to the other groups after 8 weeks; however, triglycerides decreased significantly in the same group on the 4th and 8th week ($P < 0.05$). Additionally, several immune parameters, namely, IgM, lysozyme, complement components C3 and C4, and respiratory burst of blood leukocytes significantly increased in the 3% fed group on the 4th week; while, after 8 weeks the immune responses enhanced in fish fed 2 and 3% diets ($P < 0.05$). At the end of the feeding trial, mucus samples obtained from the fish fed stinging nettle supplementation exhibited improved antagonistic activities against several bacterial pathogens (Streptococcus iniae, Yersinia ruckeri, Vibrio anguillarum and Lactococcus garviae), skin mucus enzymes activities (alkaline phosphatase, lysozyme, protease and esterase) and protein levels in 2 and 3% groups with the highest being in case of 3% group when compared to the other groups ($P < 0.05$). The cumulative mortality of rainbow trout subjected to Y. ruckeri infectious exhibited relatively low mortality levels in all supplemented groups with the lowest being in fish fed 3% stinging nettle. The present findings demonstrated that dietary administration of U. dioica enhanced growth and stimulated fish immunity; thus, enabling the fish to be more resistant against bacterial infections.