Effect of mycotoxin co-occurrence on zootechnical performance and health indices of *Sparus aurata* L.

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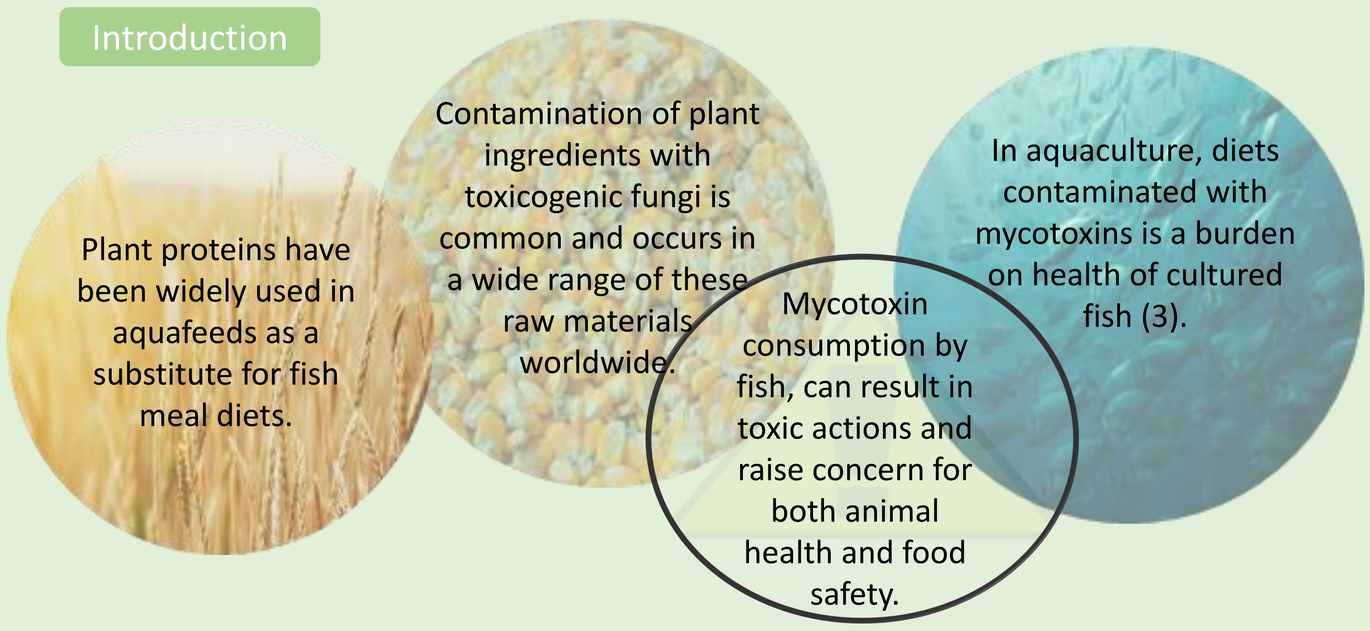
Introduction



Aim: To evaluate the impact of co-exposure of Aflatoxin B1 (AFB1), Fumonisin B1 (FB), and Deoxynivalenol (DON) in graded contamination levels, on zootechnical parameters and health indices on gilthead seabream (*Sparus aurata*).

Materials and Methods

Fish : Gilthead seabreams, *Sparus aurata* L. (3.40±0.5g)
Experimental diets: A (DON:500, FB:1000, AFB1:5 ppb), B (DON:150, FB:650, AFB1:2 ppb), C (DON:3000, FB:40, AFB1:2 ppb), D (DON:150, FB:40, AFB1:10 ppb), E (DON:150, FB:100, AFB1:2 ppb).
The control group (CTRL) was fed with a marine-based, mycotoxin-free diet.
Feeding method: Hand-fed, ad libitum, 6 days a week
Experiment duration: 12 weeks
Daily record: Food consumption and mortality
Sampling:
✓Energy utilization (feed intake and growth)
✓Haematological parameters (haematocrit-HCT, red blood cell-RBC, and white blood cell-WBC)
✓Immunological parameters (complement, anti-protease, myeloperoxidase, alkaline phosphatase, and ceruloplasmin activities)

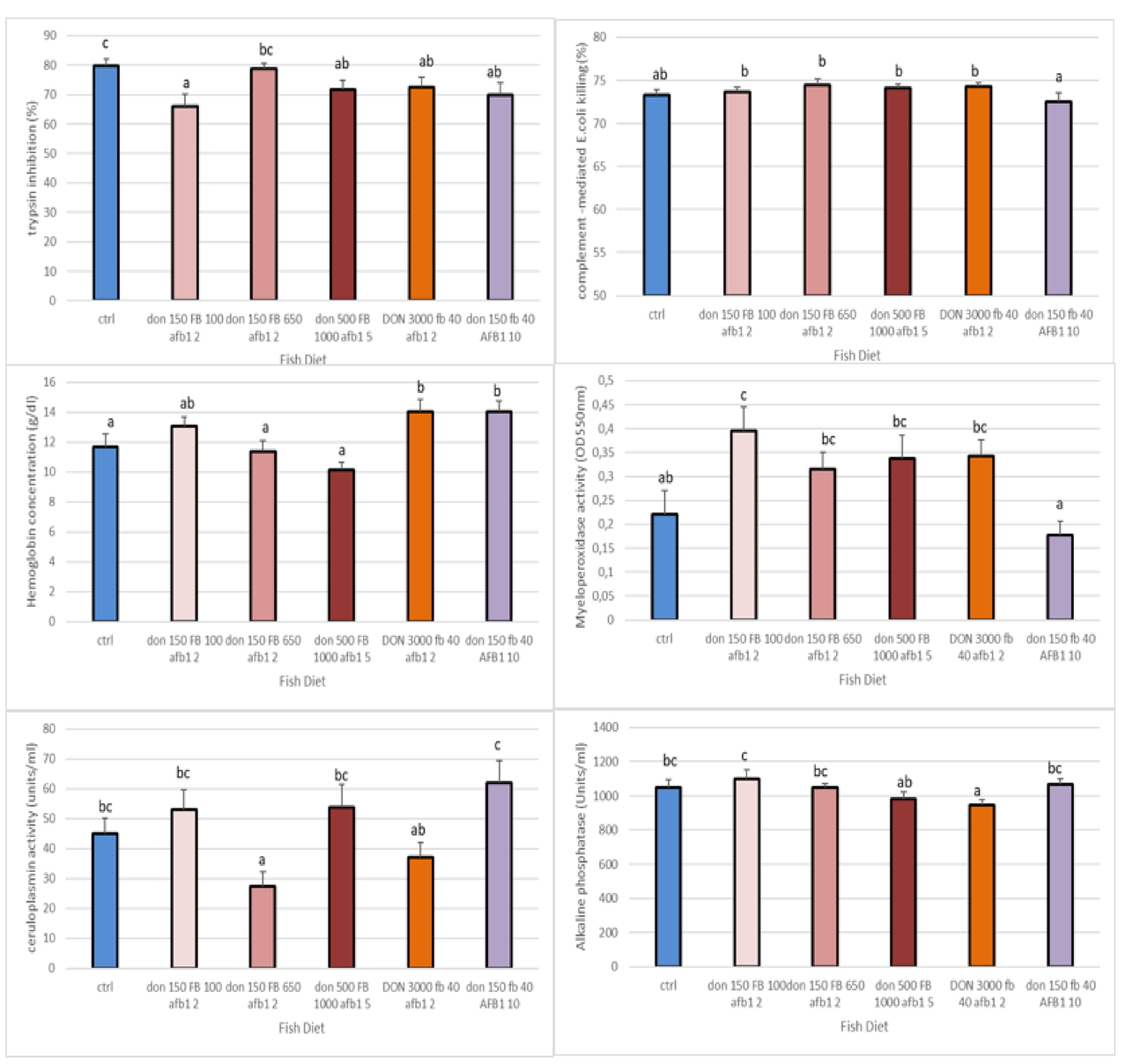
Results

All treatments containing mycotoxins caused significantly lower food consumption compared to the control group.

- Lowest feed intake: Group C (high DON) , Group D (high AFB1)
- Inferior growth: Group B, C, D, E
- Lower haematocrit: All groups compared to the CTRL
- Lowest haematocrit: Group A (high FB)
- Increased hemoglobin: Group C (high DON) , D (high AFB1)
- Decreased complement, trypsin inhibition and/or alkaline phosphatase: Group C (high DON), D (high AFB1)

Parameters/ Dietary groups	A	B	C	D	E	CTRL
Feed consumed per fish (g fish^{-1})	48.30±1.20^{de}	46.03±0.50^{cd}	37.20±2.17^{a}	41.10±1.53^{ab}	42.20±2.68^{bc}	51.97±2.33^{e}
IBW (g fish^{-1})	7.63±0.06^{a}	7.60±0.00^{a}	7.63±0.06^{a}	7.60±0.00^{a}	7.60±0.00^{a}	7.63±0.06^{a}
FBW (g fish^{-1})	49.21±2.01^{c}	47.53±1.56^{bc}	38.93±1.86^{a}	43.43±1.43^{ab}	41.98±3.22^{a}	51.01±2.46^{c}
FCR	1.16±0.03^{a}	1.15±0.03^{a}	1.19±0,02^{a}	1.15±0.03^{a}	1.23±0.06^{a}	1.20±0.01^{a}
SGR	2.49±0.05^{ab}	2.62±0.05^{bc}	2.44±0.11^{a}	2.33±0.07^{a}	2.66±0.05^{c}	2.72±0.05^{c}
HTC	30.67±5.90^{a}	33.87±5.95^{ab}	36.67±3.87^{b}	34.93±7.09^{ab}	37.47±4.21^{b}	44.40±5.85^{c}
RBC (10^{6}µL^{-1})	1.49±0.33^{a}	1.39±0.26^{a}	1.39±0.32^{a}	1.02±0.19^{a}	1.10±0.20^{a}	2.59±0.79^{b}
WBC (10^{3}µL^{-1})	35.86±11.48	28.00±5.77	41.75±13,65	50.67±19.75	33.33±16,48	58.33±45,10

Values are presented as means ± standard deviation of the triplicate groups of each treatment. In each parameter examined, symbol with a different letter indicates a statistically significant difference between treatments (P<0.05).



Immunological parameters. Values are presented as means ± standard deviation of the triplicate groups of each treatment. In each parameter examined, symbol with a different letter indicates a statistically significant difference between treatments (P<0.05).

Discussion & Conclusions

All treatments containing mycotoxins caused significantly lower food consumption, inferior growth and lower haematocrit compared to the CTRL group. Significant decreases in the erythrocytes, leucocytes, and the haematocrit values were previously observed in fish fed with diets with a mixture of FB and AFB1 (1). Diets C and D showed strong effects with significantly elevated hemoglobin and reduced complement, trypsin inhibition and/or alkaline phosphatase activities. The inhibitory action of AFB1 was already shown in Indian major carp with a significant immunosuppressive effect including reduced serum total globulin and reduced bactericidal activities (2).

Conclusion: The dietary addition of DON, FB and AFB1 showed a dose-dependent negative effect on gilthead seabream growth and health.

References

(1) Adeyemo, B. T., Enefe, N. G., Kayode, T. B., Ezekwesili, A., Olabode, O. H., Zakariya, A., Oladele, G. M., Abalaka, S. E., Nafarnda, W. D., & Alawa, C. B. I., 2022. Effects of Dietary Lanthanum Chloride on Growth Performance, Hematology and Serum Biochemistry of Juvenile Clarias gariepinus Catfish Fed Diets Amended with Mixtures of Aflatoxin B1 and Fumonisin B1. Toxins, 14:8.
(2) Sahoo P.K. &, Mukherjee S.C., 2001. Immunosuppressive effects of aflatoxin B1 in Indian major carp (Labeo rohita). Comp Immunol Microbiol Infect Dis. 24:3, 143-9.
(3) Zhonghao Z., Yi Z., Jinzhu Y., Wenbing Z., Kangsen M., Yanjiao Z., 2023. Evaluation of the effects of dietary mycotoxin-degrading adsorbent on juvenile turbot (Scophthalmus maximus L.) fed aflatoxin B1-contaminated diets, Aquaculture Reports, 30.

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