ATTENUATION OF POST-CTmin OXIDATIVE AND METABOLIC STRESS RESPONSES BY DIETARY TEA EXTRACT IN ASIAN SEABASS

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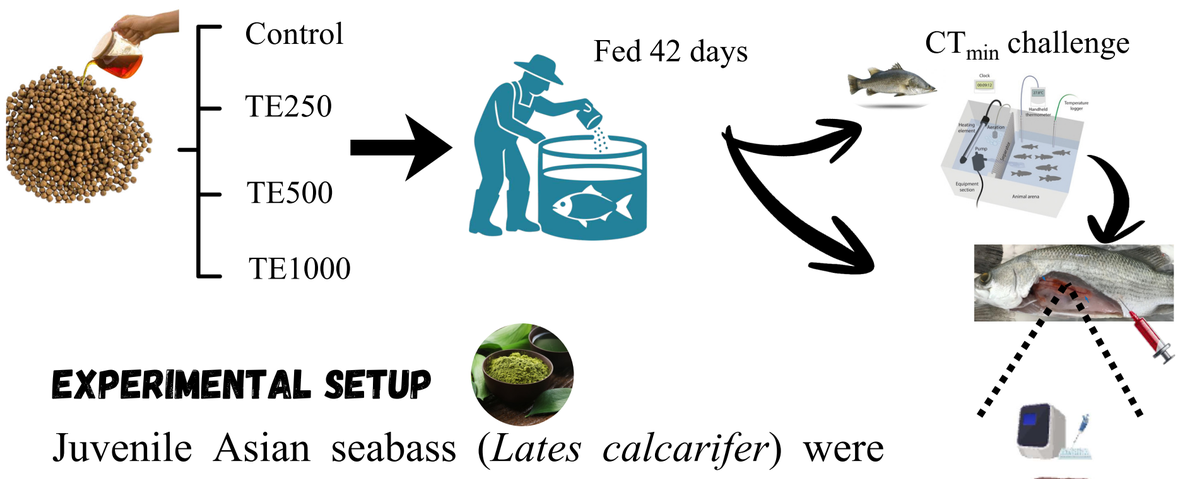
Abstract

This study evaluated whether dietary Chin-shin oolong tea extract improves growth performance, serum biochemical status, and hepatic molecular responses before and after CTmin challenge. Juvenile Asian seabass were fed diets supplemented with 0, 250, 500, or 1000 mg/kg tea extract for 42 days. Tea extract, especially at 250 and 500 mg/kg, improved growth performance and feed utilization, while serum triglyceride levels were significantly reduced. Hepatic gene expression analysis showed modulation of antioxidant- and lipid metabolism-related pathways. After CTmin challenge, tea extract-fed fish showed lower activation of stress-related genes than control fish, suggesting reduced oxidative and metabolic disturbance. These findings indicate that dietary tea extract may improve growth, metabolic balance, and cold challenge resilience in Asian seabass.

Introduction

- Asian seabass (*Lates calcarifer*) is a tropical aquaculture species whose growth and physiological performance can be affected by sudden decreases in water temperature.
- Temperature-related disturbance can alter energy metabolism and increase oxidative pressure, particularly in metabolically active tissues such as the liver[1].
- Nutritional strategies using plant-derived bioactive compounds are gaining attention as practical approaches to improve fish resilience under environmental challenges.
- Tea extract (*Camellia sinensis*) is rich in polyphenolic compounds that may support antioxidant capacity, lipid metabolism, and physiological homeostasis[2].
- Therefore, this study investigated whether dietary Chin-shin oolong tea extract could improve growth performance, serum biochemical status, and hepatic antioxidant- and lipid metabolism-related gene expression in Asian seabass before and after CTmin challenge.

Materials & Methods



EXPERIMENTAL SETUP

Juvenile Asian seabass (*Lates calcarifer*) were fed a commercial diet supplemented with Chin-shin oolong tea extract at 0, 250, 500, or 1000 mg/kg for 42 days. After the feeding trial, growth performance and serum biochemical parameters were evaluated. Liver samples were collected from non-challenged fish to represent the basal physiological condition. A separate subset of fish was then subjected to a CTmin challenge, and liver samples were collected 24 h later to assess the post-challenge molecular response.

GENE EXPRESSION ANALYSIS

Liver samples were collected from each group and stored at −80°C until analysis. Total RNA was extracted using the TRIzol method, followed by cDNA synthesis. Quantitative real-time PCR was performed to analyze hepatic antioxidant- and lipid metabolism-related gene expression. Relative gene expression was normalized using ELF1a as the reference gene.

Results

Table 1. Growth performance and feed utilization of Asian seabass (*Lates calcarifer*) fed diets supplemented with tea extract for 42 days.

Groups	Control	TE250	TE500	TE1000
Initial weight (g)	14.70 ± 0.69 ^{a}	14.60 ± 0.81 ^{a}	14.58 ± 0.77 ^{a}	14.70 ± 0.80 ^{a}
Final weight (g)	64.25 ± 2.03 ^{b}	75.69 ± 3.27 ^{a}	67.95 ± 3.01 ^{a}	65.69 ± 4.19 ^{b}
Weight gain (g)	49.55 ± 2.43 ^{b}	61.09 ± 2.17 ^{a}	53.37 ± 2.74 ^{a}	50.99 ± 2.26 ^{b}
SGR (%/day)	3.51 ± 0.03 ^{b}	3.92 ± 0.03 ^{a}	3.66 ± 0.04 ^{a}	3.56 ± 0.04 ^{b}
FCR	1.18 ± 0.04 ^{a}	0.77 ± 0.04 ^{c}	0.88 ± 0.06 ^{b}	1.05 ± 0.09 ^{ab}
FE (%)	116.60 ± 1.68 ^{b}	136.20 ± 2.46 ^{a}	128.70 ± 2.77 ^{a}	116.40 ± 1.79 ^{b}
Survival (%)	100 ^{a}	100 ^{a}	100 ^{a}	100 ^{a}

Table 2. Serum biochemical parameters of Asian seabass (*Lates calcarifer*) fed diets supplemented with tea extract for 42 days.

Groups	Control	TE250	TE500	TE1000
AST (U/L)	20.60 ± 4.39	20.40 ± 6.17	25.80 ± 5.51	22.60 ± 5.64
ALP (U/L)	58.40 ± 7.11	97.00 ± 11.29	63.60 ± 4.33	68.20 ± 16.26
Total protein (g/dL)	3.14 ± 0.15	3.04 ± 0.27	3.32 ± 0.10	3.54 ± 0.26
Albumin (g/dL)	1.80 ± 0.10	1.20 ± 0.14	1.24 ± 0.054	1.42 ± 0.08
CHOL (mg/dL)	240.98 ± 12.26	236.04 ± 13.09	241.18 ± 9.31	239.68 ± 9.23
TRIG (mg/dL)	99.88 ± 11.91 ^{a}	67.20 ± 9.31 ^{b}	57.80 ± 11.15 ^{b}	102.00 ± 8.74 ^{a}
Globulin (g/L)	1.96 ± 0.69	1.84 ± 0.15	2.08 ± 0.10	2.12 ± 0.19

Note: Values are expressed as mean ± SD. TE250, TE500, and TE1000 indicate diet supplemented with 250, 500, and 1000 mg/kg tea extract, respectively. Different superscript letters within the same row indicate significant differences among groups (one-way ANOVA, $P < 0.05$).

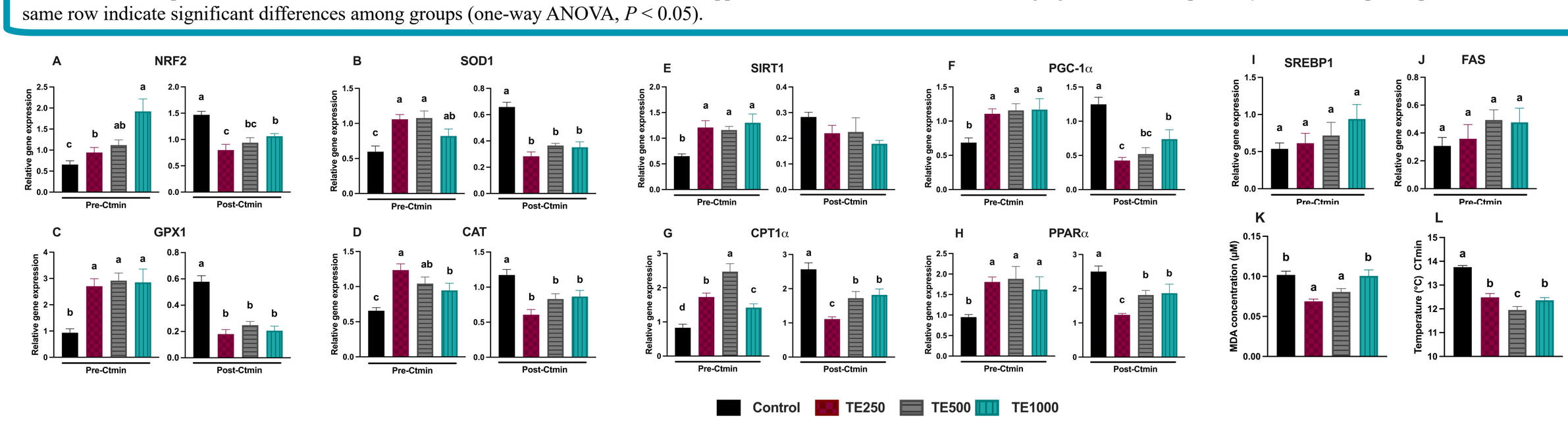


Figure 1. Hepatic expression of antioxidant-related (A–D), lipid oxidation-related (E–H), and lipid synthesis-related (I–J) genes in Asian seabass (*Lates calcarifer*) after 42 days of feeding with control or tea extract-supplemented diets, measured before and after CTmin challenge. TE250, TE500, and TE1000 indicate diets supplemented with 250, 500, and 1000 mg/kg tea extract, respectively. Gene expression was normalized using ELF1a as the reference gene. Values are expressed as mean ± S.E. (n = 6). Different letters indicate significant differences among treatment groups within the same condition by one-way ANOVA ($P < 0.05$).

Proposed Mechanistic Model

Key Findings

- ✓ Dietary Chin-shin oolong tea extract at 250–500 mg/kg improved growth performance and feed utilization in Asian seabass.
- ✓ Tea extract modulated hepatic antioxidant- and lipid metabolism-related gene expression before and after CTmin challenge.
- ✓ Serum triglycerides levels were significantly reduced in the TE250 and TE500 groups.
- ✓ After CTmin challenge, tea extract-fed fish showed lower activation of oxidative and metabolic stress-related genes compared with the control group.

References

1. Liu, T., Li, L., Yang, Y., Li, J., Yang, X., Li, L., & Liu, H. (2025). Effects of chronic cold stress and thermal stress on growth performance, hepatic apoptosis, oxidative stress, immune response and gut microbiota of juvenile hybrid sturgeon (*Acipenser baerii*♀× A. schrenkii♂). *Fish & Shellfish Immunology*, 157, 110078.
2. Lo, Y.H., Chen, Y.J., Chang, C.I., Lin, Y.W., Chen, C.Y., Lee, M.R., Lee, V. S. Y., & Tzen, J. T. C. (2014). Teaghrelins, unique acylated flavonoid tetraglycosides in Chin-shin oolong tea, are putative oral agonists of the ghrelin receptor. Journal of agricultural and food chemistry, 62(22), 5085-5091.