

Effects of dietary tall oil fatty acids with resin acids on the performance and immunity of juvenile white shrimp (*Litopenaeus vannamei*) with and without an intentional *Vibrio parahemolyticus* challenge



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INTRODUCTION

- Tall oil fatty acids (TOFA) is a feed material with 9% natural resin acids of coniferous trees. Resin acids have antimicrobial and anti-inflammatory properties.
- TOFA is used in poultry and swine diets for improved production performance and intestinal condition, but it has not been studied in aquatic species.
- Vibrio parahemolyticus* (V.p.) is a common pathogen of white shrimp (*Litopenaeus vannamei*) in Thailand
- The aim: to study the effect of dietary TOFA at 0.5 and 1.0 kg/ton on the performance and immunity of white shrimp.
- The protocol included an 8-week period without a challenge factor, followed by a 7-day V.p. challenge.



CONCLUSIONS

Dietary TOFA significantly improved growth, survival and immunity of white shrimp, and reduced *Vibrio* load in the tissues. TOFA may become a dietary strategy for supporting the performance and disease resistance of white shrimp.

RESULTS AND DISCUSSION

Dietary TOFA significantly improved shrimp performance (data in the abstract), and survival rate after the challenge (Figure 1), compared to the control treatment. *Vibrio* count in the tissue samples was significantly decreased by TOFA, especially post-challenge (Figure 2). Many physiological and immunity-related parameters were increased by both TOFA dosages (Table 1). These results suggest improved immunity, disease resistance and performance of juvenile white shrimp with dietary TOFA amendment.

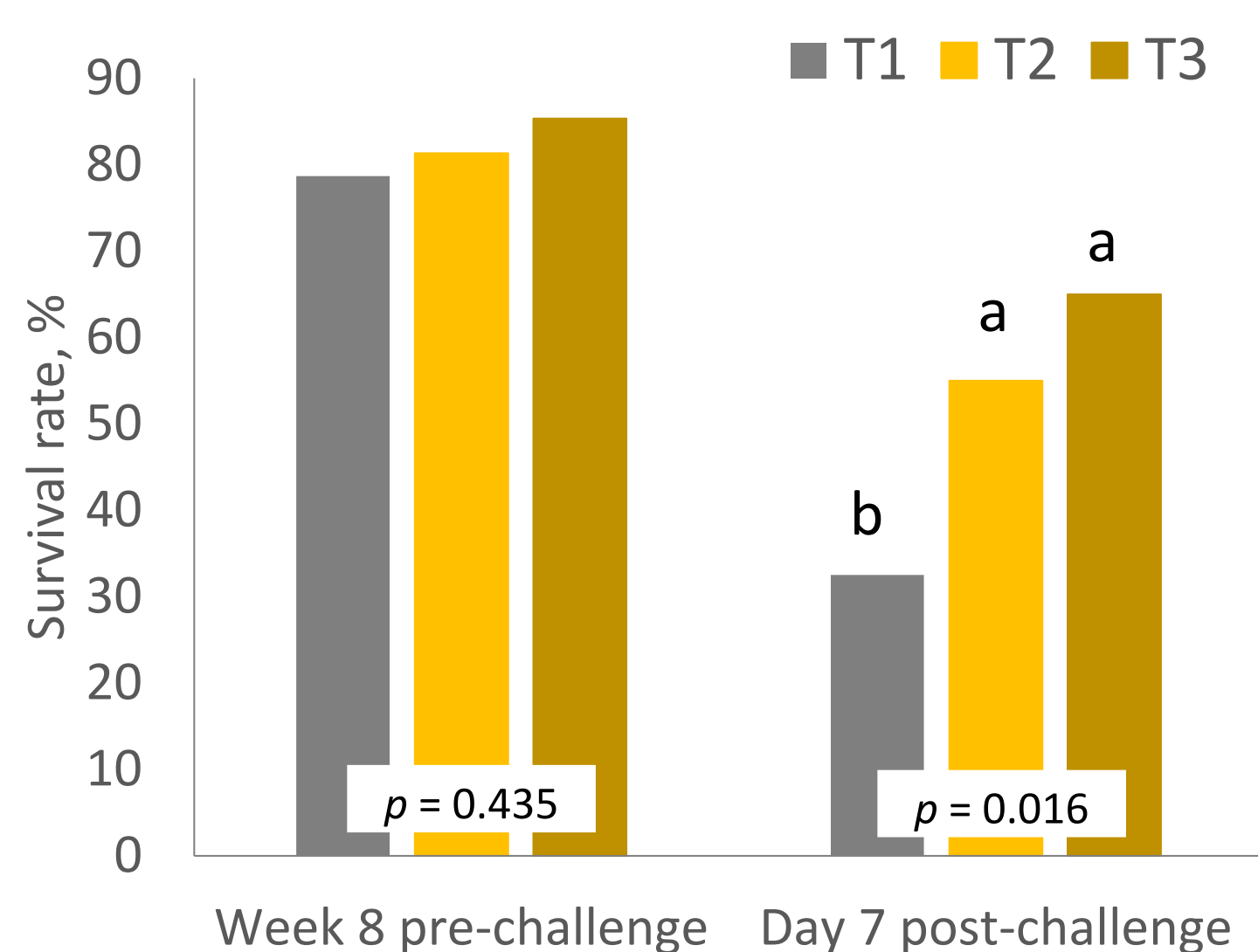


Figure 1. Shrimp survival rate, %

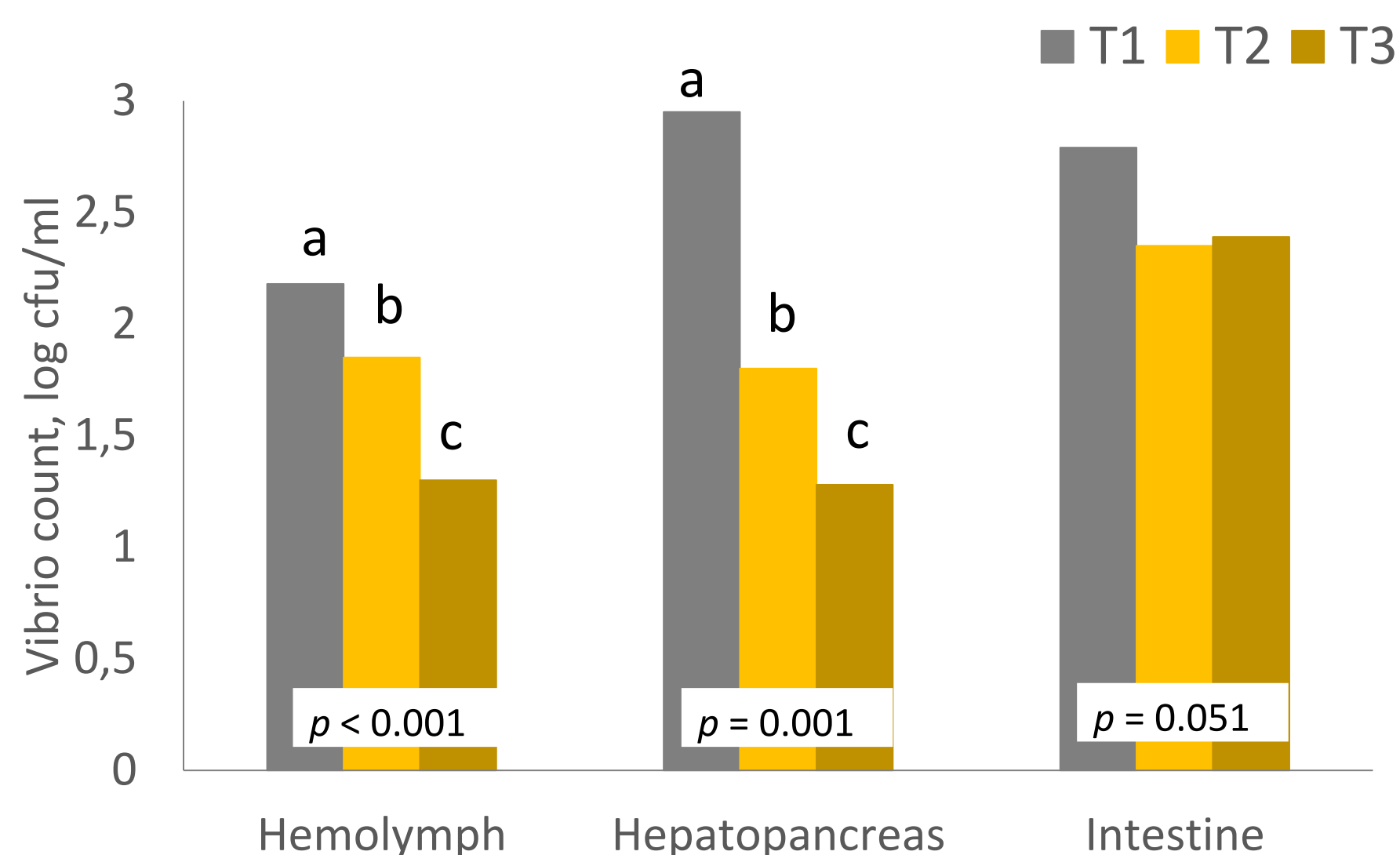


Figure 2. *Vibrio* count in the tissue samples, (log₁₀ cfu/ml), 7 days post-challenge

Table 1. Effects of the dietary treatments on parameters measured from haemolymph samples at the 8-week time point (pre-challenge) and 7 days post-challenge.

Item	Week 8 pre-challenge				Day 7 post-challenge			
	T1 ¹	T2 ²	T3 ³	p-value	T1 ¹	T2 ²	T3 ³	p-value
Haemocyte count (*10 ⁵ cell/ml)	23.17 ^c	25.17 ^b	28.33 ^a	0.013	11.50 ^b	14.75 ^a	16.25 ^a	0.003
Haemolymph protein (g/dl)	5.02	5.23	5.34	0.309	3.50 ^c	3.97 ^b	4.70 ^a	<0.001
Phenoloxidase act. (unit/min/mg prot.)	32.60 ^b	44.52 ^a	48.33 ^a	<0.001	44.47 ^b	50.92 ^a	52.67 ^a	0.017
Lysozyme activity (unit/ml)	162.00 ^c	201.83 ^b	223.00 ^a	<0.001	404.13 ^b	590.50 ^a	634.88 ^a	0.009
Superoxide dismutase (unit/ml)	13.31 ^b	16.22 ^a	16.81 ^a	0.004	7.83 ^b	10.26 ^a	11.01 ^a	0.006
Glutathione (nmol/ml)	19.97 ^b	30.52 ^a	38.88 ^a	0.001	76.12 ^b	94.90 ^a	99.58 ^a	0.006

¹TOFA 0 kg/ton, ²TOFA 0.5 kg/ton, ³TOFA 1.0 kg/ton, ^{a, b, c} Different letters in the same row: p<0.05 difference between treatments.

MATERIALS AND METHODS

Dietary treatments and study outline

T1: TOFA at 0 kg/ton (Control)

T2: TOFA at 0.5 kg/ton

T3: TOFA at 1.0 kg/ton

- Test material: TOFA (Progres®, AB Vista, UK).
- 30 aquariums with 120 liters of 15 ppt saline water, at Kasetsart University, Thailand.
- 25 juvenile white shrimp/aquarium.
- Feed was applied 3x/day, 3-5% of body weight. Uneaten feed was removed, dried, and weighed.
- 6 shrimp/tr. were sampled for haemolymph, hepatopancreas and intestinal contents at 8 wk.

Challenge period

- 3 replicate aquariums/treatment.
- Vibrio parahemolyticus* challenge by a subcutaneous injection of the virulent EMS strain (6.9*10⁷ cfu/ml) to each shrimp.
- Survival rate was monitored daily.
- Sampling for haemolymph, hepatopancreas and intestinal contents on day 7 post-challenge.

Data analysis

- Completely randomized design.
- One-way ANOVA, followed by Duncan's Multiple Range Test.
- p<0.05 as a limit for statistical significance.