EFFECT OF DIETARY AUTOLYSED BREWER'S YEAST ON THE GROWTH PERFORMANCE, INTESTINAL HEALTH, AND IMMUNE RESPONSE OF NILE TILAPIA *Oreochromis niloticus* FRY

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Introduction

The Nile tilapia is one of the most widely and abundantly farmed fish species globally. Despite rapid growth in recent years the sector still faces serious health challenges in many countries (Barley 2022), which undermines sustainability. With this, there is a constant need to improve existing knowledge and to develop new diets using sustainable additives such as yeast derivates. Brewer's yeast is rich in nutrients and bioactive substances such as β-glucans, mannan-oligosaccharides, and nucleotides which have been demonstrated to improve growth performance, health, and immune response of farmed fish (Merrifield & Ringø, 2014). The present study was conducted to evaluate the potential of dietary supplementation of autolysed brewer's yeast (ABY) on Nile tilapia growth performance, feed utilisation and intestinal health.

Materials and Methods

Fish: Hatchery bred Nile tilapia fry (0.45 g) from University of Stirling

System: Freshwater recirculatory aquaculture system (RAS) at the University of Plymouth, 15 L tanks, Temperature 26.1±0.5 °C, pH 6.93±0.41, DO 7.64±0.24 mg/L, NH_4 0.20±0.38, NO_3 24.73±13.52, NO_2 0.03±0.03

Duration: 5 weeks

Treatments: 4 diets: 1 basal diet, 3 ABY (CeFi® Pro, Leiber GmbH) diets

Design: 3 replicates per treatment; 40 fish / tank

Feeding

- Diets formulated to meet known nutrient requirements (NRC, 2011) for tilapia (Table 1)
- Fed at 5% biomass per day

Table 1: Feed formulations and proximate composition

Ingredients (g/100g)	Control	ABY1	ABY2	ABY4
Soybean Meal 48	40.00	40.00	40.00	40.00
Sunflower meal	24.67	24.57	24.47	24.27
Fishmeal	15.00	15.00	15.00	15.00
SPC60	9.98	9.98	9.98	9.98
Sunflower oil	8.67	8.67	8.67	8.67
DL methonine	0.17	0.17	0.17	0.17
Lysine	0.50	0.50	0.50	0.50
Fish premix	0.50	0.50	0.50	0.50
CMC	0.50	0.50	0.50	0.50
CeFi® Pro	-	0.10	0.20	0.40
Proximate Composition (%, dry matter basis)				
Protein	46.21	47.39	47.43	46.44
Lipid	11.14	10.85	10.73	11.32
Moisture	4.47	4.20	3.76	3.60
Ash	6.63	6.85	6.89	6.92
NFE	31.55	30.71	31.19	31.72

Results and Discussion

1. Significant improvement of growth by ABY

- Fish fed ABY1 showed significant improvements in final weight, MWG, SGR, and FCR compared to fish fed control diet (Table 2).
- Greatest improvements were observed in fish fed ABY1.
- This suggests that low level supplementation of autolyzed brewer's yeast in Nile tilapia diets has the potential to improve the growth performance which is similar to the findings of Adeoye et al. (2020).

Table 2: Growth performance of Nile tilapia fed the experimental diets

	Control	ABY1	ABY2	ABY4
Initial weight (g)	0.46±0.01	0.45±0.02	0.46±0.02	0.45±0.01
Final weight (g)	1.13±0.07^{a}	1.38±0.21^{b}	1.21±0.12^{ab}	1.12±0.02^{a}
MWG (g)	0.67±0.06^{a}	0.93±0.20^{b}	0.75±0.11^{a}	0.68±0.01^{a}
SGR (%wt/day)	2.64±0.12^{a}	3.28±0.36^{b}	2.86±0.23^{a}	2.71±0.04^{a}
FCR	1.99±0.09^{a}	1.55±0.23^{b}	1.78±0.16^{ab}	1.91±0.06^{a}

Data are mean values ± standard deviation (SD). Values with different alphabetical superscripts are significantly different (P < 0.05).

2. Intestinal histology

- All treatments displayed normal intestinal physiology characterised by extensive mucosa folds with simple lamina propria and intact epithelial barrier.
- No statistically significant differences of fold height, muscularis thickness, lamina propria widths & goblet cells count were observed (Fig 1A-D).

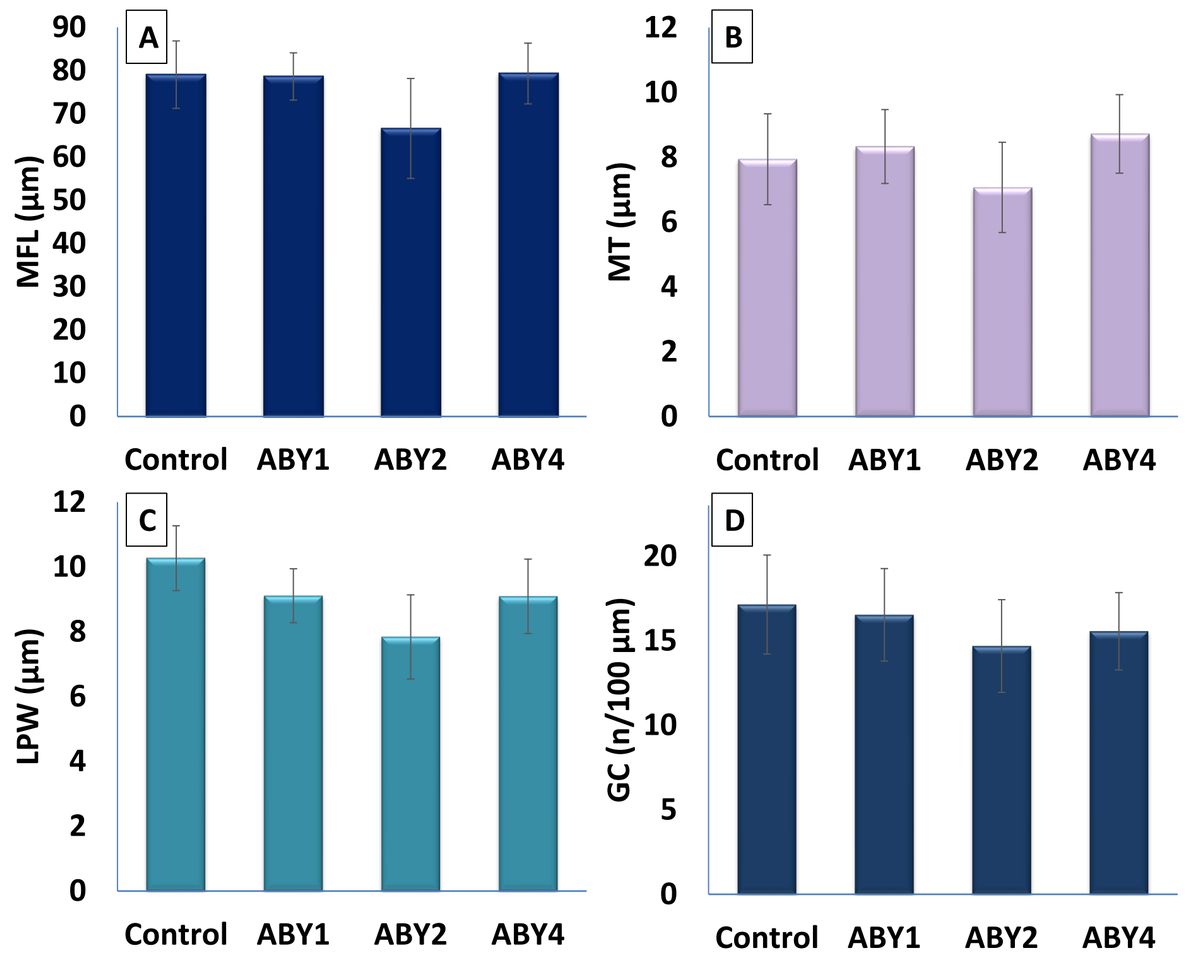

Fig 1: A) mucosal fold length (MFL), B) muscularis thickness (MT), C) lamina propria width (LPW), and D) goblet cell count (GC) of Nile tilapia fry fed various treatments. Values represented as Mean ± SD

3. Significant modulation of intestinal genes by ABY

- The expression levels of *tlr2*, *il10*, and *il1β* were significantly upregulated in ABY1 group while *tnfα* was significantly downregulated in the ABY1 and ABY2 groups (Fig 2 A-D).
- Also, ABY1 significantly upregulated *igm* and *occludin*, while no significant modification was observed for *claudin3* in all groups (Supplementary file).
- Similar findings reported by several studies; *tlr2*, *il10*, and *il1β* (Rawlings et al., 2021), *igm* and *occludin* (Cai et al., 2023); *tnfα* (Falco et al., 2012).

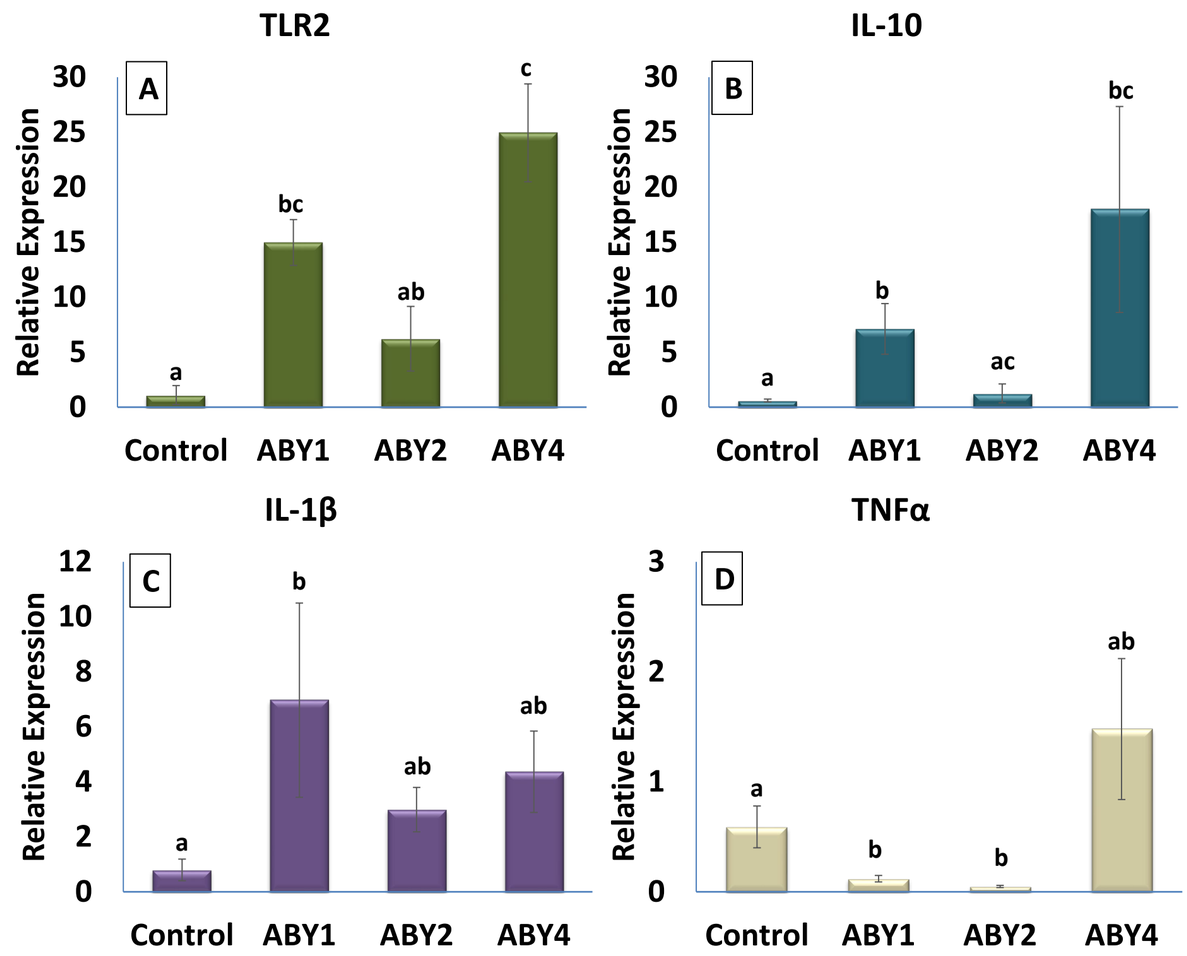

Fig 2: Relative expression of A) TLR2, B) IL-10, C) IL-1β, and D) TNFα in intestine of Nile tilapia fry fed various treatments. Treatments with different letter above the error bars are significantly different ($p < 0.05$). Values represented are Mean ± SEM

Conclusions

The study indicates that supplementing diets with ABY, specifically at 1 g/kg level, enhances growth performance and modulates the intestinal gene expression of Nile tilapia fry, without compromising intestinal integrity.

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References (In supplementary file)

Supplementary File