



The effect of Butirex C4 on growth performance, digestive enzymes activity, immune parameters, and resistance to infectious bacterial diseases in *litopenaeus vannamei*

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The aim of this study was to investigate the effect of Butirex C4 on the parameters of immunity and health of shrimp and its relationship with feed efficiency and productivity

Method and material:

Experimental design: 3 × 3 factorial, 3 replicates per treatment

- 3 levels 0 (control group), 0.3 and 0.6% of Butirex C4
- 3 different level of fish meal (45, 30 and 15%) replaced by soybean meal

Husbandry: shrimp farm with automatic feeder and aeration system that were stocked with 50-60 post larvae per square meter. Physical and chemical parameters of the water quality have been measured daily. The amount of BOD of water was also measured weekly

Experimental diet: Basal diets with 45, 30 or 15% of fish meal were isonutritives (CP = 38; EE = 7). Experimental diet will be prepared by adding ButirexC4 at 3 and 6 g/kg to the basal diets. and were pelleted and steamed

Measurements:

- Growth performance and feed efficiency
- Digestive enzyme activity
- Antioxidant activity
- Stress situation: 1) Hypoxic stress: [O₂] was reduced to 0.8 - 1 mg O₂/l for 72 h
- Stress situation: 2) Challenge tests with *Vibrio harveyi*, adding ~10⁷ CFU ml/l water
- Bacteria count
- Economic analysis



Results and discussion: (Only the effect of Butirex-C4 is showed, for more information, contact us)

Digestive enzyme activity: Total protease, Amylase, Lipase, Trypsin and chymotrypsin activity increased as the level of Butirex-C4 in the diet increased (Figure 1). However, the improvement was similar between 0.3 and 0.6% of Butirex-C4 (P value of 0.007 in total protease activity)

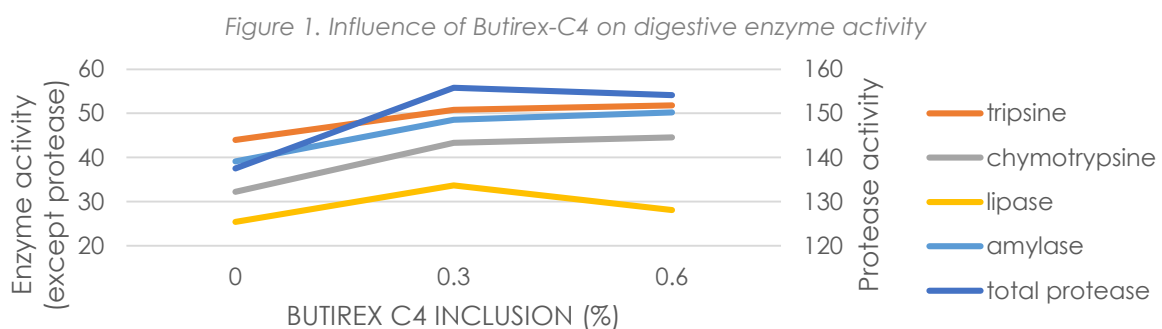
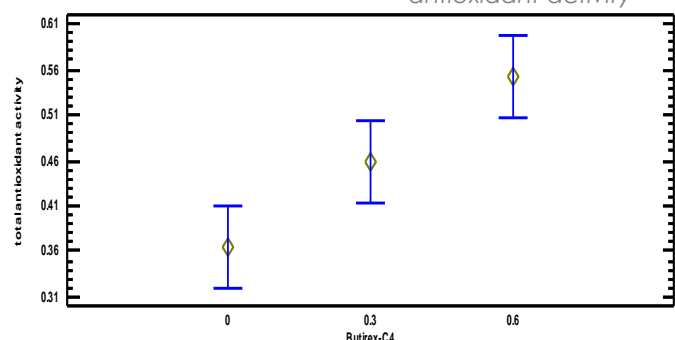


Figure 2. Influence of Butirex-C4 on total antioxidant activity



Antioxidant activity: The result of immunological parameters revealed that in all groups with different levels of fish meal that the supplementation with Butirex C4 increased antioxidant activity significantly (P<0.05; Figure 2).

Growth performance and feed efficiency (N=27):

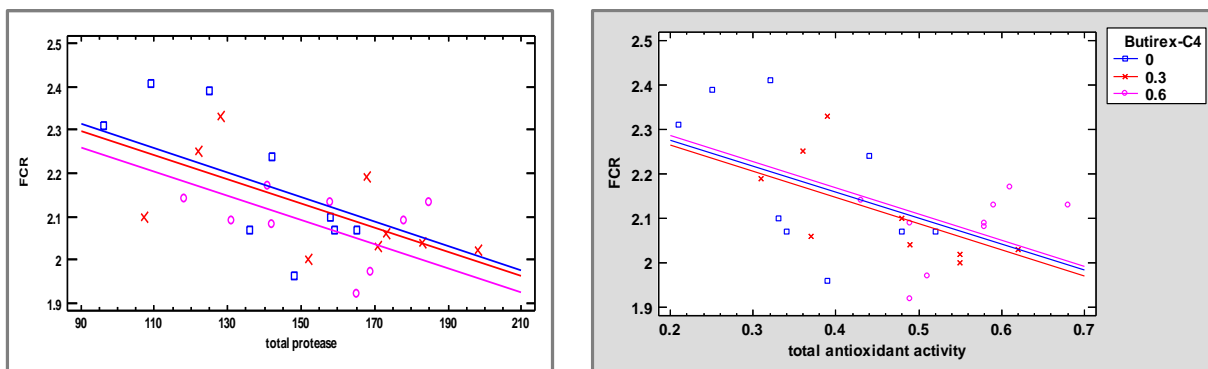
Butirex-C4 improved all parameters related with growth performance (Table 1).

Also, there was a very good correlation between feed efficiency and other parameters. In fact, when total protease and antioxidant activity increased, the feed conversion ratio improved (Figure 3)

Table 1. Influence of Butirex-C4 on digestive enzyme activity

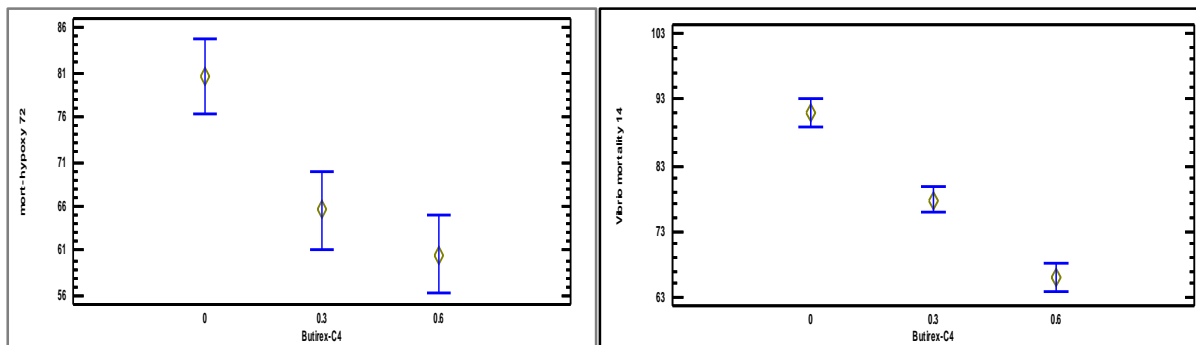
Butirex-C4	BWG	FI	FCR	Survival
0	12.2a	26.4a	2.18a	62.4a
0.3	13.1b	27.6b	2.11ab	61.4a
0.6	13.5b	28.1b	2.08b	68.8b
P value	0.001	0.006	0.061	0.001

Figure 3. Correlation between FCR and total protease and antioxidant activity



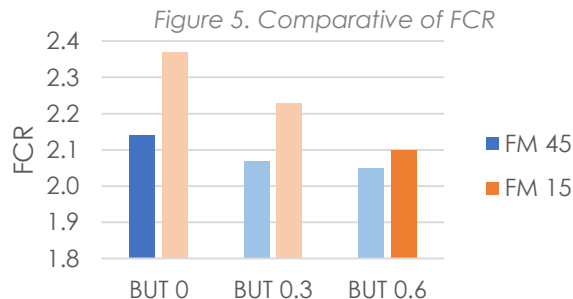
Stress situation: mortality after hypoxic stress (72 h) and after challenge tests with *Vibrio harveyi* (14 d) shown that Butirex-C4 also increase the survival of shrimps after that, may by due to the better antioxidant status and growth ($P < 0.01$ in both cases).

Figure 4. Influence of Butirex-C4 on mortality after stress situations



Bacterial count: Butirex-C4 improved microflora of the shrimp, decreasing vibrio count (8.58 vs. 6.28×10^4 CFU for control and 0.6% Butirex, respectively; $P < 0.001$) and increasing lactic acid bacteria (3.83 vs. 4.58×10^6 CFU for control and 0.6% Butirex, respectively; $P < 0.01$).

Economic analysis: The FCR was similar for the treatment with 0.6% of Butirex-C4 and 15% of fish meal and the treatment with 0% of Butirex-C4 and 45% of fish meal (Figure 5). In this respect, to increase the fish meal in the diet from 15 to 45% increased the feed price in 27.8%, but to increase the Butirex C4 in the diet from 0 to 0.6% increased the feed price in and 3.3%.



Conclusions:

With Butirex-C4 Improve:

