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Effect of natural composition of green Ulva sp. and enhancing its nutritional value in Nile tilapia "Oreochromis niloticus" diets

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List of Abbreviation

Abbreviation	Name
ALT	Alanine aminotransferase
ANFs	Antinutritional factors
AST	Aspartate aminotransferase
CNM	Corn meal
DO	Dissolved oxygen level
EAA	Essential amino acids
ER	Energy retention
FAMEs	Fatty acid methyl ester
FCR	Feed conversion ratio
FER	Feed efficiency ratio
FI	Feed intake
FM	Fishmeal based diet
FBW	Final body weight
GC	Gas Chromatography
GLC	Gas Liquid Chromatography
Hb	Hemoglobin
HIS	Hepato somatic index
HPLC	High Performance Liquid Chromatography
Ht	Hematocrite
K	Fulton condition factor
LC	L-carnitine
LYM	Lymphocytes
MCV	Mean corpuscular volume
MEM	Multi-enzymes based diet
MUFAs	Monounsaturated Fas
NEAAs	non-essential amino acids
NFE%	Nitrogen-Free Extract
NSP	Non-starch polysaccharides
PER	Protein efficiency ratio
PHY	Phytase based diet

PLT	Platelets
PPV %	Protein productive value
PUFA	Polyunsaturated fatty acids
RBCs	Red blood cells
RGR	Relative growth rate
Rt	Retention time
SFAs	The saturated fatty acids
SBM	Soybean meal
SGR	Specific growth rate
SR	Survival rate
TAAs	Total amino acids
TFAs	Total fatty acid
TN	Total nitrogen
UM	*Ulva* meal
VSI	Viscera-somatic index
WB	Wheat bran
WBCs	White blood cells
XYL	Xylanase based diet

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Abstract

This study was carried out to investigate the phytochemical constituents and biological screening of green algae (*Ulva lactuca*) methanolic crude extract. The HPLC spectrum profile identified seven phenolic and flavonoid compounds namely: catechin, chlorogenic, caffeic, quercetin, and major compounds, ellagic acid with 60.87 % and rutin with 33.40% of total area. The GC profile of fatty acids portions represented to relative distribution percentage were 9 compounds, the major fatty acids are lauric acid 55.0 %, caprylic acid 21.2 %, capric acid was 19.8 and palmitic acid was 1.94%. The 17 amino acids produced from GC spectrum represented both free and combined amino acids, were detected in *Ulva lactuca*. The percentage of total amino acid were 25.98%. The most abundant amino acids were glutamic acid 2.34%, alanine 2.22 and aspartic 2.09, leucine 1.33, valine 1.26, phenylalanine 1.0, threonine 0.98 and isoleucine 0.9% of total amino acid.

The first experiment was conducted to investigate the effect of plant-*Ulva lactuca* (PL-Ulva) based diets supplementation with exogenous enzymes (mono or multi-enzymes complex) and yeast on growth performance, feed utilization, hematological and biochemical parameters of Nile tilapia (*Oreochromis niloticus*). Six isonitrogenous and isocaloric diets were formulated to provide 28% protein and 425 kcal/100 g diets. The treatments were: (1) positive control diet (FM-based), (2) negative control diet (PL-Ulva based diet), (3) PL-Ulva based diet + 1.50 g phytase/kg, (4) PL-Ulva based diet + 1.50 g xylanase/kg and (5) PL-Ulva based diet + 3 g yeast /kg (6) PL-Ulva based diet + 1.50 g multi-enzymes complex /kg. Each diet was offered twice daily to apparent satiation in triplicate fish groups (5.14 g /fish) for 12 weeks. The highest significant means ($p \leq 0.05$) of growth performance and survival rate values and the best values of feed conversion ratio, protein efficiency ratio, protein productive value%, and energy retention% were achieved by fish meal based diet and plant-Ulva based diets supplemented with different enzymes or yeast compared to plant Ulva based diet without supplementation. Insignificant differences ($p>0.05$) were found in body composition among treatments groups. The highest values of blood parameters (Hb, RBCs, and Ht) were obtained with fish fed multienzymes based diet (MEM) compared to the other treatments, while the lowest

one was recorded with plant meal based diet. There were no significant differences in total protein serum and albumin among various experimental treatments. There were no significant differences among all treatments in serum AST level, however fish fed plant meal based diet recorded the highest value of serum aspartate amino transferase (AST). The results suggested that supplementation of plant-Ulva based diet with enzymes or yeast can improve the nutrient utilization and growth performance of Nile tilapia. Also, it has an economic return and can be considered as an efficient means to formulate cost effective diets.

A second (2X3) factorial design was conducted to evaluate the effect of using fermented *Ulva* (FER) and exogenous multi-enzymes, Natuzyme® (MEM, 1.5 g/kg) supplementation in combination with L-carnitine (LC, 350 mg/kg) and/or probiotic (PRO, 0.3%/kg) on growth performance, feed utilization, hematological and biochemical parameters of Nile tilapia (5.14±0.08 g initial body weight) fed plant-*Ulva* based diets over a 12-week feeding trial. Six isonitrogenous and isocaloric diets were formulated to provide 28% protein and 425 kcal/100 g diets which divided to FER and MEM groups each with three different supplementations (LC, PRO and LC + PRO). Results of the present study revealed that fish fed on the third diet (FER + LC + PRO) and the last diet (MEM + LC + PRO) showed higher average body weight, weight gain and relative body weight gain without any significant difference between the two treatments. Fish fed (FER + LC + PRO) diet and (MEM + LC + PRO) diet consumed more diet than other treatments. No significant differences were detected among different fish groups for whole body composition. Fish fed the third diet containing (fermented ulva, L-carnitine, probiotic) and the sixth diet containing normal Ulva in combination with (multi-enzyme mixture, L-carnitine, probiotic) recorded the highest value of Hb and RBCs, total protein, albumin and globulin. There were no significant differences among all treatments in serum AST levels. The results of present study suggested that using fermented Ulva and inclusion of exogenous digestive enzymes in combination with L-Carnitine and/or probiotic have beneficial effects on improving growth performance, feed utilization and reducing feed cost of Nile tilapia.