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Advances in Animal and Veterinary Sciences

Research Article

Effects of Supplementing Shrimp Soluble Hydrolyte Extracts on Growth Performance and Digestion of Hoa Lan Ducks

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Abstract | A study was carried out aiming to evaluate the utilization capacity of shrimp soluble hydrolyte extracts of Hoa Lan ducks. It was a complete randomized design with 5 treatments corresponding to 5 diets and 3 replications. Ten ducks balancing in sex were used in one experimental unit. The treatment 0 (basic diet, 0%). Treatment 1, 2, 3 and 4 were mixed basic and shrimp soluble hydrolysate with 1%, 2%, 3% and 4%, respectively (DM). The treatments were: SH0, SH1, SH2, SH3 and SH4, respectively. The results shown that daily weight gain (DWG) was lower for the ducks without supplementing shrimp hydrolyte (SH0 treatment) than those mix shrimp hydrolyte (drinking water) and the significantly higher result found in the SH2, SH3 and SH4 treaments ($P<0.05$). FCR of Ha Lan ducks were better in the SH3 and SH4 treatments ($P <0.05$). Accumulated Nitrogen (Nr) of SH2, SH3 and SH4 treatments were higest (60.3g/kg, 61.3g/kg and 61.2g/kg, respectively). It was concluded that the treatments supplemented with hydrolyzed shrimp juice at 3% and 4% gave higher results in terms of weight gain and low feed conversion ratio.

Keywords | Hoa Lan duck, Shrimp soluble extracts

Received | November 05, 2021; **Accepted** | December 10, 2021; **Published** | January 05, 2022
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Citation | Nha PT, Thuy LT (2022). Effects of supplementing shrimp soluble hydrolyte extracts on growth performance and digestion of hoa lan ducks. Adv. Anim. Vet. Sci. 10(2): 286-291.
DOI | http://dx.doi.org/10.17582/journal.aavs/2022/10.2.286.291
ISSN (Online) | 2307-8316

INTRODUCTION

Hoa Lan ducks have good growth, few diseases are easy to raise. People can use food sources available at home to save money. Commercial meat is always reasonably priced, so it is suitable for large-scale herd development. Spending money on the construction of the barn is not much.

Consumers are increasingly looking for quality over price, so this promotes the development of duck farming. Hoa Lan ducks provide an opportunity to increase income and reduce poverty for local people who do not have high incomes. Hoa Lan ducks meat is delicious, opening rate is lower than other duck breeds. Ducks are easy to raise the ability to use feed by-products well. Ducks are commonly raised among farmers in the Mekong Delta (Nguyen et al., 2017).

Shrimp is the main export processing product of the seafood processing industry products of Vietnam. At the same time, the large amount of shrimp exported every year causes waste. Shrimp heads and shells also make up a huge amount. According to some studies, the proportion of by-products of shrimp processing accounts for 50% (30-55%) (by fresh weight). Protein hydrolysis from aquatic ingredients has become popular in the food industry due to its high protein content (Colrdova-Murueta et al., 2007). Protein hydrolysis reduces the size of the peptides, and the hydrolyzate is an available source of amino acids for protein biosynthesis.

Specifically, shrimp juice has many advantages compared to similar products on the market. Taste-stimulating products help pets eat better, more, gain weight faster, reduce feed conversion rate (FCR), reduce stress, increase survival rate, etc. According to the latest analysis results from Novozymes Corporation, products with low molecular weight (under 500 Dalton account for more than 93%) help increase resistance for livestock, thereby increasing

economic efficiency, bringing high profits. for breeders (VNF Company). According to the research results of Pham et al. (2019) on broiler chickens, adding 1-2% of shrimp juice has a higher profit than no supplement (increasing 10-15% of profit).

Objectives of the study

- Find out the appropriate level of shrimp hydrolysis to raise Dutch ducks for meat.
- Determine the digestibility of nutrients in the diet when adding shrimp hydrolyzate.

MATERIALS AND METHODS

Location and climate of the study area

Experiment was conducted from Jan to May in 2021, at a private farm (a householder) in Vinh Long province. The chemical analysis of feeds was done at the laboratory of the Department of Animal sciences. Faculty of Agriculture of Can Tho University.

Experimental animals

One day old-Ha Lan ducks were bought from a Hoa Lan ducks breeding farm in Long An province. Ha Lan ducks from 2 to 21 days were fed special concentrate pellet (20% CP). The Hoa Lan ducks at 22 days of age were introduced to the trial, all Hoa Lan ducks were vaccinated H5N9. Duck cholera vaccine and some common diseases before using in the trial.

Experimental design and treatments

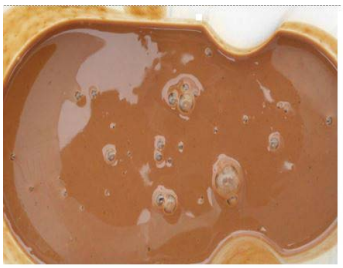
One hundred and fifty Ha Lan ducks at 4 weeks of age (545±5.0 g/duck) were allotted in a completely randomized design with 5 treatments and 3 replicates and 10 ducks per experimental unit (balanced sex). The treatments were the different shrimp hydrolyte supplement levels of 0; 1; 2; 3 and 4 % (shrimp hydrolyte mix in the water) to put in drinking water, corresponding to the SH0 (basal water), SH1, SH2, SH3 and SH4 treatments, respectively). The trial lasted 5 weeks with Ha Lan ducks from 4 to 8 weeks of age.

Digestive experiment

The experimental setup was the same as the growth experiment. Each experimental unit has 2 ducks (1 male: 1 female). The experiment was performed at 6 weeks of age. The experimental period was 14 days (7 days to get the ducks used to the feed and 7 days to take feed and faeces samples). Feed ingredients of basal diet was presented in Table 1.

Feeds for experiment

All feed ingredients were bought in one occasion from feed store for throughout the experiment. The basal diet was formulated and contained 3020 kcal ME/kgDM and 16% CP. Shrimp hydrolyte were finely mixed with the water following experimental design before feeding. Chemical compositions of shrimp hydrolyte, feed ingredients and basal diet were presented in Tables 1 and 2.



Shrimp hydrolyte

Ha Lan ducks preparing for experiment

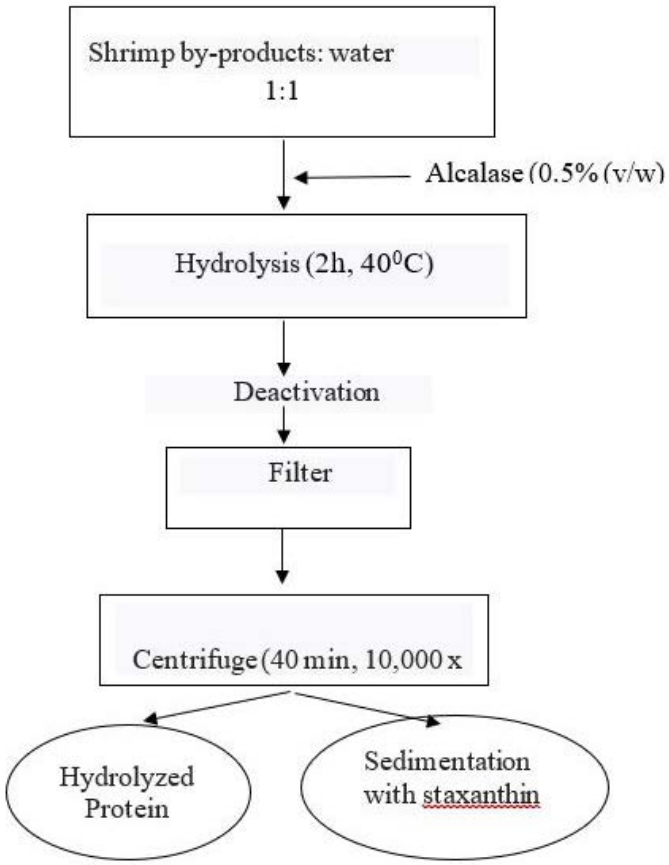


Figure: Hydrolysis process of shrimp juice.

Housing and management

House for ducks was made by wood and tole. Experimental birds were confined in pens with 5.0 m^2/10 ducks, which were surrounded by wood, plastic net and its floor was overlaid with 20 cm of sand and rice straw layer in its surface for bedding. Feeders and drinkers were put in front of each cage. Feeders and drinkers were cleaned daily every morning and chicken litters were removed weekly. The ducks were fed 3 times daily at 7.00, 13.00 and 17.00 h and feed offered to the ducks was weekly adjusted by an increase from 5 % to 10% according to real feed intake. Ducks were freely to access water.

Table 1a: Chemical compositions of the ingredients in diets (%).

Ingredients	DM	OM	CP	EE	CF	Ash	ME* (kcal/kg DM)
Paddy	88.9	95.1	7.2	1.64	11.1	4.80	2.930
Soybean extraction	89.5	94.8	43.3	1.22	5.46	6.73	2.482
Pangasius meal	89.7	78.2	42.9	15.9	3.7	21.5	3.143
Shrimp hydrolyte	31.9	84.5	67.1	6.4	3.85	15.5	-

* Jansen (1989).

Table 1b: Amino acid composition in hydrolyzed shrimp juice (%).

Shrimp hydrolyte	1.47% aspartic acid	0.71% serine	2.33% Glutamic acid	1.43% glycine	0.56% histidine	1.22% arginine
	0.83% threonine	2.17% alanine	1.01% proline	0.23% cystine	0.64% tyrosine	1.14% valine
	0.46% methionine	0.95% lysine	0.90% isoleucine	1.43% leucine	1.04% phenyl alanine	

VNF company (2019).

Table 2: Chemical compositions of feed ingredients in diet (% DM).

Ingredients (%)	Treatments				
	SH0	SH1	SH2	SH3	SH4
Paddy	73	73	73	73	73
Soybean extraction	10	10	10	10	10
Pangasius meal	16	16	16	16	16
Shrimp hydrolyzate	0% mix in drinking water	1% mix in drinking water	2% mix in drinking water	3% mix in drinking water	4% mix in drinking water
Mineral and vitamin	1	1	1	1	1
Total	100	100	100	100	100
DM	88.19	88.19	88.19	88.19	88.19
OM	92.29	92.29	92.29	92.29	92.29
CP	16.00	16.00	16.00	16.00	16.00
EE	2.95	2.95	2.95	2.95	2.95
CF	9.34	9.34	9.34	9.34	9.34
Ash	6.86	6.86	6.86	6.86	6.86
ME* (kcal/kg)	3,020	3,020	3,020	3,020	3,020

DM: dry matter, OM: orgarnic matter, CP: crude protein, EE: ether extraction, CF: crude fibre, NDF: neutral detergent fibre, ME*: metablolizable ernergy (Janssen, 1989).

Measurements

Daily intakes of feed and nutrients: Feed and refusals were collected and weighed daily morning. Daily weight gain and feed conversion ratio: the ducks were weighed weekly and at the end of experiment. Carcass values: after finishing 4 ducks (2 male and 2 female) per each experimental unit were slaughtered for the evaluation of carcass traits. Body measurements of birds were described by Salomon (1996).

Digestive experiment

Accumulated Nitrogen: Content of accumulated nitrogen per 1kg test diets was calculated by using the following formula:

$Nr = (N_d - N_e \times AIA_d/AIA_e) \times 1000/100$ (Lammers et al., 2008)

Where: N_r: Mass of accumulated nitrogen (g/ kg); N_d: Content of Nitrogen in a diet (%); N_e: Content of Nitrogen in faeces (%); AIA_d: Content of acid chlorhydric insoluble ash in a diet (%); AIA_e Content of HCl-insoluble minerals in faeces (%).

Determine the ratio of nutrient digestibility in diet

Apparent digestibility EE, dry matter (DM), organic matter (OM) and CF in a diet calculated according to the formula of Huang et al. (2005) as follows:

$$DD = (1 - [(ID \times AF) / (IF \times AD)]) \times 100$$

DD: Full apparent digestibility tatio of nutrients in diet (%); ID: Ash content (AIA) in diet insoluble in acid (mg/

kg); AF: Nutrient content in waste (mg/ kg); IF: AIA content insoluble in acid of waste (mg/ kg); AD: Nutrient content in diet (mg/ kg).

Table 3: Daily intakes of feed and nutrient of Ha Lan duck (g/duck/day).

Item	Treatment					SEM	P
	SH0	SH1	SH2	SH3	SH4		
DM	127^{a}	122^{c}	125^{a}	119^{c}	118^{c}	0.43	0.001
OM	117.2^{a}	112.6^{b}	115.4^{b}	109.8^{c}	108.9^{c}	0,43	0,034
CP	20.3^{a}	19.52^{ab}	20.0^{a}	19.04^{b}	18.88^{b}	0,12	0,019
EE	3.75^{a}	3.60^{bc}	3.69^{b}	3.51^{c}	3.48^{c}	0,02	0,001

^{a,b,c} Mean values with different superscripts within the same row are different at P<0 05.

Chemical analyses

Feeds offered were analyzed for chemical compositions: DM, OM, CP, EE, CF, Ash. They were analyzed following procedures of AOAC (1990). NDF analysis was followed the Van-Soest et al. (1991) and ME was calculated by Janssen (1989).

Statistical analysis

Data were analyzed by using General Linear Model (GLM) of Minitab progam 16.1.0 (Minitab, 2010) and the comparison of significant difference between two treatments was done by Tukey method of Minitab (2010).

RESULTS AND DISCUSSION

Daily intakes of feed and nutrients of growing Ha Lan ducks

Daily intakes of DM, OM, CP and EE were significantly lower (P<0.05) for the ducks given SH4 (4% shrimp hydrolyte mix in the water) than for other treatments with the highest values observed in duck group mix SH0 treatment. The DM and CP intakes in the present trial are higher than those of a previous study on Muscovy duck (115-121 gDM/day; 16.6-18.8 gCP/day, respectively) reported by Nguyen et al. (2005).

Effects of dietary different shrimp hydrolyte supplement on the growth performance of growing Ha Lan duck

Table 4 shows that daily weight gain (DWG) was lower for the ducks without supplementing shrimp hydrolyte (SH0 treament) than those drinking shrimp hydrolyte and the significantly higher result found in the SH2, SH3 and SH4 treaments (P<0.05). The DWG obtained are closed with the results of 40.4g - 49.7 g/bird, but being slightly higher than the values of 34.4 -36.8 g/duck in previous trials on Muscovy duck (Men et al., 1996; Nguyen, 2010, respectively). Final live weights were significantly higher for the ducks supplemented shrimp hydrolyte than that of those in the SH0 treatment (P<0.05), resulting from higher daily weight gain. The final live weights in this trial are in a range of 2650- 3140g of a previous experiment on Muscovy duck (Dang et al., 2012). FCR of Ha Lan ducks were better in the SH3 and SH4 treatments (P <0.05), it could be due to higher daily weight gain. The results of FCR were lower than with the values of 2.96-3.66 reported by Nguyen et al. (2017).

Table 4: Daily weight gain, final live weight and feed conversion ratio (FCR) of Ha Lan duck (g/bird).

Item	Treatments					SEM	P
	SH0	SH1	SH2	SH3	SH4		
Initial live weight	542	546	547	545	554	4.36	0.388
Final live weight	2327^{c}	2353^{b}	2402^{ab}	2432^{a}	2407^{ab}	12.1	0.011
Daily weight gain	51.0^{b}	51.6^{ab}	53.0^{a}	53.9^{a}	53.1^{a}	0.32	0.01
FCR	2.49^{a}	2.37^{b}	2.36^{b}	2.20^{c}	2.23^{c}	0.012	0.001

^{a,b,c} Mean values with different superscripts within the same row are different at P<0 05.

Figure 1 showed that when adding hydrolyzed shrimp juice to the drinking water, the daily weight gain of ducks increased compared to without supplementation.

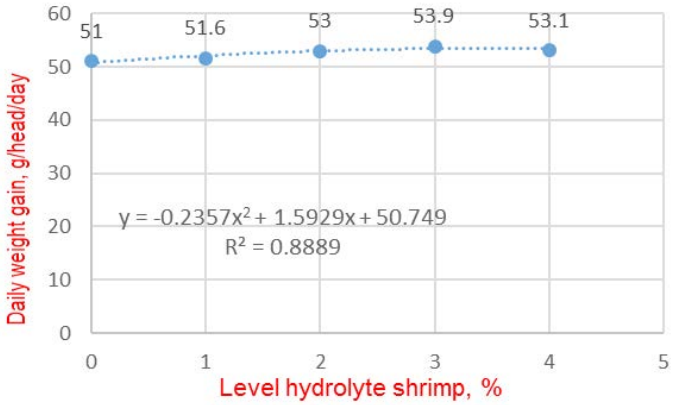


Figure 1: The effect of hydrolyzed shrimp juice on daily weight gain.

Figure 2 showed that the addition of hydrolyte shrimp juice caused the FCR to decrease compared to the control treatment. The decrease in FCR was due to the hydrolysis of shrimp containing many essential amino acids necessary for the growth of ducks.

Effects of dietary different shrimp hydrolyte supplement on carcass quality of growing Ha Lan duck

Slaughter weights of duck were correspondent to the final live weights. Carcass weight were significantly higher in the SH3 and SH4 treatments (P<0.05) (Table 5). Percentage

of carcass was closed among the treatments (P> 0.05), these results are in a range of 69.5%-72.6%, published by Nguyen et al. (2017). Breast meat and thigh meat weights were significantly (P<0.05), highest in SH3 and SH4 treatments. Percentages of breast meat and thigh meat were resembled among the treatments (P> 0.05).

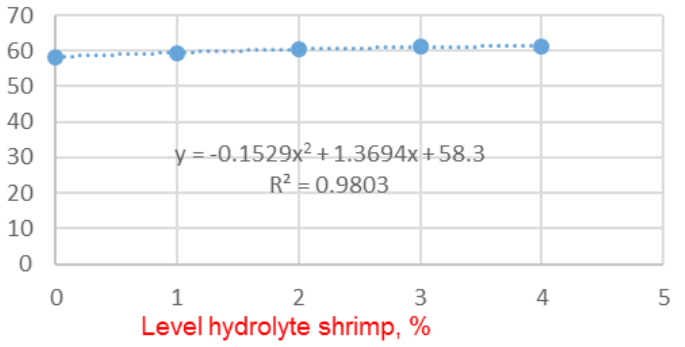


Figure 2: The effect of hydrolyzed shrimp juice on FCR.

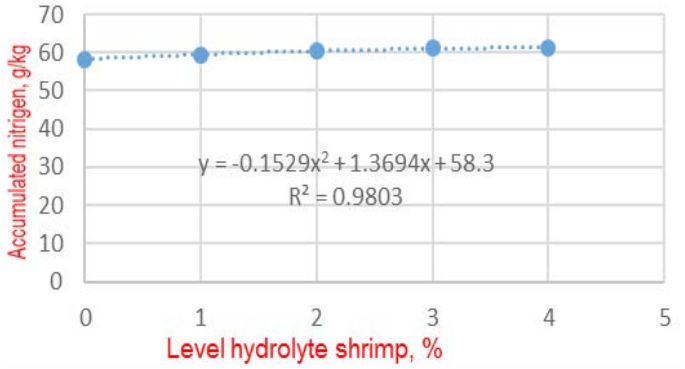


Figure 3: The effect of hydrolyzed shrimp juice on accumulated nitrogen.

Table 5: Caracass values and internal organs of Ha Lan duck Supplemented shrimp hydrolyte in diets (g/duck).

Item	Treatment					SE	P
	SH0	SH1	SH2	SH3	SH4		
Slaughter live weight	2.330^{c}	2.360^{bc}	2.410^{b}	2.440^{a}	2.415^{ab}	18.12	0.001
Carcass weight	1668^{c}	1671^{c}	1723^{b}	1771^{a}	1765^{a}	14.7	0.001
% Carcass	71.6	70.8	71.5	72.6	73.1	0.16	0.063
Breast meat weight	326^{c}	324^{c}	340^{bc}	354^{a}	353^{a}	3.10	0.021
% Breast meat	19.55	19.36	19.73	20.01	20.02	0.11	0.342
Thigh meat weight	315^{c}	321^{c}	329^{bc}	340^{a}	344^{a}	3.0	0.007
%Thigh meat	18.9	19.2	19.1	19.2	19.5	0.27	0.068

$^{a, b, c}$ Mean values with different superscripts within the same row are different at P<0 05.

Table 6: Percentage of total nutrient digestibility in experiment diet.

Ingredients (%)	Experiment diet					SEM	P
	SH0	SH1	SH2	SH3	SH4		
DMD	87.4^{c}	88.7^{b}	89.5^{a}	89.7^{a}	89.2^{a}	0.18	0.015
OMD	89.5^{c}	90.1^{b}	90.6^{ab}	91.7^{a}	91.7^{a}	0.07	0.035
Nr (g/kg)	58.4^{c}	59.5^{b}	60.3^{ab}	61.3^{a}	61.2^{a}	0.11	0.018
EED	80.0^{c}	81.2^{b}	82.2^{a}	82.3^{a}	82.1^{a}	0.15	0.022
CFD	34.07^{c}	35.14^{bc}	36.11^{ab}	37.06^{a}	37.08^{a}	0.16	0.001

DMD: Dry matter digestibility; OMD: Organic matter digestibility; EED: Ether extract digestibility; CFD: Crude fiber digestibility; Nr: Accumulated Nitrogen.

Digestive experiment

The results showed that the apparent digestibility coefficients of nutrients in feeds were considerably valuable. The nutrients in the test feed ingredients were well digested. The DM and OM digestibility coefficient of SH2, SH3 and SH4 treatments were higest (DM: 89.5%, 89.7% and 89.2%; OM: 90.6%, 91.7% and 91.7%, respectively). The EE digestibility coefficients of SH2, SH3 and SH4 treatments were higest (82.2%, 82.3% and 82.1%, respectively). The CF digestibility coefficient of SH3 and SH4 treatments were higher than that of treatments. Also, Accumulated Nitrogen (Nr) of SH3 and SH4 treatments were higest (61.3g/kg and 61.2 g/kg, respectively).

CONCLUSIONS AND RECOMMENDATIONS

- Ha Lan ducks have grown and developed well when drinking water supplemented with hydrolyzed shrimp juice.
- The drinking water supplemented with hydrolyzed shrimp juice at 3% gave higher results in terms of weight gain and low feed conversion ratio.
- The nutrient digestibility of the treatment with hydrolyzed shrimp juice on Ha Lan duck also achieved good results.

ACKNOWLEDGMENTS

I am grateful to the JAPAN's ODA Project for finance and gave me the opportunity to undertake this experiment. Thank you VN Food company for supporting the hydrolysis of shrimp and squid for us to complete this experiment.

AUTHOR'S CONTRIBUTION

All authors contributed equally.

Conflict of interest

The authors have declared no conflict of interest.

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