

Effect of different supplement levels of soybean pomace in the basal mixed feed diet on the growth performance of Muscovy ducks (*Cairina moschata*)

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ABSTRACT

An experiment was conducted on 72 healthy Muscovy ducks, starting at 28 days of age, to evaluate the effect of different soybean pomace supplementation levels in the basic mixed feed on the growth performance of Muscovy ducks (*Cairina moschata*). The experiment was arranged in a Completely Randomized Design (CRD) with 3 treatments and 3 replications. Each experimental unit consisted of 8 Muscovy ducks, with four of male and four of female were randomly selected. The three treatments were designed with 3 soybean pomace supplement levels of 0, 15 and 30% in the basic mixed. Treatment 0 (TM0) consisted of 100% mixed feed only, Treatment 1 (TM1) included 15% soybean pomace and 85% mixed feed, and Treatment 2 (TM2) contained 30% soybean pomace and 70% mixed feed. The results of the weight gain of Muscovy ducks from 5 to 12 weeks showed that Treatment 1 had the significantly higher weight gain (36.40g/duck/day) ($P \leq 0.05$), than those of Treatment 2 (33.89g/duck/day) and Treatment 0 (32.78g/duck/day). The feed conversion ratio (FCR) was the lowest in Treatment 1 (3.89), followed by Treatment 2 (4.15), and highest in Treatment 0 (4.41), with ($P \leq 0.05$). Among the three treatments, the treatment 1 included 15% soybean pomace combined with 85% mixed feed had higher weight gain and better feed conversion ratio as compared to those of the two other treatments. It was concluded that at 15% soybean pomace supplement in basic mixed feed diet gave the higher growth performance and better feed conversion ratio of Muscovy ducks.

Keywords: Muscovy duck, soybean pomace, weight gain, feed conversion ratio.

Introduction

Poultry farming is a prominent model of development in the Mekong Delta, with Muscovy duck farming being quite popular. The advantage in the Mekong Delta lies in the dense river network and extensive agricultural land, most of which is used for cultivating food crops such as rice, maize, and sweet potatoes...which are useful feed resources for animal husbandry. Muscovy ducks stand out due to low investment costs and easy access to locally available feeds depending on the farmer's capacity (Hua Long Son, 2022). Consumers prefer Muscovy duck meat due to its high breast meat percentage,

low fat, and high nutritional value, with crude protein (CP) ranging from 19.6% to 21% and fat (EE) at 2.47%. The growth period of Muscovy ducks is short, easy to raise, with low disease incidence and low housing costs (Nguyen Thuy Linh *et al.*, 2020). However, Muscovy ducks require adequate nutrients for growth requirement, so farmers must pay attention to their feed diets.

In the model of raising Muscovy ducks using locally available feed sources, soybean pomace, which is often discarded during tofu production, could be utilized. Soybean pomace is low-cost and contains significant nutrients, with a crude

protein (CP) content of 20.7% (Nguyen Thi Kim Dong, 2009). With such a nutrient profile, it can replace part of the feed in the Muscovy duck diet.

Based on these factors, the study “Effect of different supplement levels of soybean pomace in the basal feed diet on the growth performance of Muscovy ducks (*Cairina moschata*) “ was conducted to assess the effect of this by product on the weight gain of Muscovy ducks.

Materials and methods

Materials

Two experimental feeds including the soybean pomace and mixed feed were used. The soybean pomace was purchased daily from a tofu production facility in Minh Luong Commune,

while the mixed feed was sourced from NOVA Company. The nutritional composition of the soybean pomace was analyzed based on dry matter (DM) content and crude protein (CP) content according to AOAC (1990) standards. The sample for nutritional composition analysis was processed at the Animal Science Laboratory, Faculty of Agriculture and Natural Resources, An Giang University.

Table 1. Chemical composition of feeds used in the experiment

Item, %	Soybean pomace	Mixed feed
DM	10.4	86.00
CP	19.7	19.00
CF	-	7.00



Picture 1. Soybean pomace



Picture 2. Mixed feed

Location and time

The experiment was conducted from January 2023 to April 2023 in Minh Long Hamlet, Minh Luong Commune, Chau Thanh District, Kien Giang Province.

Experimental design

The experiment was arranged in a Completely Randomized Design (CRD) with 3 treatments

and 3 replications. Each experimental unit consisted of 8 Muscovy ducks, with four of male and four of female were randomly selected. The experiment involved three treatments with different feeding ratios of mixed feed and soybean pomace. Treatment 0 (TM0) consisted of 100% mixed feed, Treatment 1 (TM1) included 15% soybean pomace in fresh form and 85% mixed feed, and Treatment 2 (TM2)

contained 30% soybean pomace and 70% mixed feed. The Muscovy ducks at 28 days of age with average live weight from 72 Muscovy ducks were introduced in the trial and housed in a total of 9 pens. The experiment lasted 8 weeks.

Feeding and management

The experimental feed included soybean pomace purchased daily from a tofu production facility, it was weighed and mixed into the mixed feed according to the (specific ratios for) each treatment. All three treatments were fed twice a day, at 7:00 AM and 2:00 PM. The leftover feed was collected and weighed each morning. The

clean drinking water always supplied for ducks during day and night.

Measurements

Data was collected to measure live weight, weight gain, feed consumption, and feed conversion ratio (FCR). The average weight of the ducks was monitored weekly, and on a fixed day each week, the experimental ducks were weighed to calculate the average weight using a specific formula.

Average weight of duck:

$$\text{Average live weight of duck} = \frac{\text{Total weight of duck (g)}}{\text{Total weight of duck}}$$

Weight gain of experimental ducks was determined:

$$\text{Weight gain of ducks} = \text{Final live weight} - \text{Initial weight}$$

Feed intake of duck over the weeks:

$$\text{Feed intake (g/duck/day)} = \frac{\text{Total amount of feed to consume} - \text{Total amount of leftovers}}{\text{Total number of ducks} \times 7 \text{ days}}$$

Feed conversion ratio:

$$\text{Feed conversion ratio} = \frac{\text{Daily feed intake}}{\text{Daily weight gain}}$$

Statistical analysis

The collected data was initially processed and stored in an Excel spreadsheet, then statistically analyzed ANOVA by using MINITAB software, version 20.1 (2020). The differences between the treatments with a 95% confidence level, the significance level was determined at $P = 0.05$.

Results and discussion

Live weight of Muscovy ducks over age stages

The results of the weight of Muscovy ducks over the experimental weeks are shown in Table 2.

Table 2. Average live weight of Muscovy ducks over weeks of age (g/duck)

Week of age	Treatment			SE	P
	TM0	TM 1	TM 2		
Initial weight	352.75	347.33	348.08	3.78	0.57
5	641.38 ^a	591.00 ^b	562.58 ^c	3.55	0.00
6	823.33 ^a	768.50 ^{ab}	722.00 ^b	9.40	0.02
7	1,059.58 ^a	988.17 ^b	935.42 ^c	6.47	0.00
8	1,308.13 ^a	1,183.50 ^c	1259.04 ^b	5.57	0.00
9	1,663.54 ^a	1,584.17 ^c	1,637.67 ^b	3.51	0.00
10	2,140.17 ^a	2,108.13 ^b	2,060.29 ^c	4.35	0.00
11	2,553.83 ^a	2,523.33 ^b	2,469.75 ^c	4.77	0.00
12	2,959.75 ^b	2,990.21 ^a	2,910.21 ^c	4.82	0.00

Note: Treatment 0: (100% Mixed feed); Treatment 1: (15% Soybean pomace and 85% Mixed feed); Treatment 2: (30 Soybean pomace and 70% Mixed feed); ^{a,b,c}Data from the same row that share at least one symbol are not different at $P < 0.05$

From the data in Table 2, it can be seen that the duck weights in the initial experimental treatments were relatively similar. This is a favorable factor to confirm that the differences in weight gain and feed conversion ratio of the experimental ducks are not influenced by the initial weight differences. The weights of the treatments in the 5th week were as follows: TM0 (641.38 g) and TM1 (591.00 g), with the lowest value being in the TM2 treatment (562.58 g). Therefore, this difference is statistically significant ($P \leq 0.05$). The duck weights in the treatments increased each week, depending on the nutrient absorption of the ducks, leading to weight differences over the weeks. This is consistent with the normal growth of the ducks, when the feed has met the nutritional requirement for the growth of the ducks (Farhat *et al.*, 1998). From the 5th week

to the 11th week, the weights of the treatments showed statistically significant differences at ($P < 0.05$). By the 12th week, the average weight was highest in the TM1 treatment with 2,990 g/duck, followed by TM0 with 2,959.8 g/duck, and the lowest in TM2 with 2,910 g/duck, with this difference being statistically significant ($P < 0.05$). From these values obtained, it indicated that the supplementation of soybean pomace at 15% in the mixed feed diet had the higher growth performance of Muscovy ducks.

Weight gain of Muscovy ducks over the weeks of age

Weight gain is a crucial production indicator for Muscovy ducks since it shows the animals' potential for growth. Table 3 displays the weight gain of Muscovy ducks over weeks of age.

Table 3. Weight gain of Muscovy ducks over the weeks of age (g/duck/day)

Week of age	Treatment			SE	P
	TM0	TM 1	TM 2		
5	41.23 ^a	34.81 ^b	30.64 ^c	3.53	0.00
6	25.99	25.36	22.77	3.97	0.03
7	33.75	23.81	38.06	3.61	0.07
8	35.51 ^b	35.48 ^b	38.66 ^a	5.50	0.00
9	50.77 ^c	57.24 ^a	54.09 ^b	5.58	0.00
10	68.09 ^b	74.85 ^a	60.37 ^c	5.09	0.00
11	59.10 ^{ab}	59.32 ^a	58.49 ^b	2.79	0.04
12	57.99 ^b	66.70 ^a	62.92 ^a	2.02	0.00
AVG	32.78 ^b	36.40 ^a	33.89 ^b	3.28	0.03

Note: Treatment 0: (100% Mixed feed); Treatment 1: (15% Soybean pomace and 85% Mixed feed); Treatment 2: (30 Soybean pomace and 70% Mixed feed). ^{a,b,c}Data from the same row that share at least one symbol are not different at $P < 0.05$.

The results in Table 3 show that the weight gain of the experimental ducks in the 5th and 6th weeks was highest in TM0 (41.23 g/duck/day) and (25.99 g/duck/day), followed by TM1 (34.81 g/duck/day) and (25.36 g/duck/day), and the lowest in TM2 (30.64 g/duck/day) and (22.77 g/duck/day). This difference was statistically significant at ($P < 0.05$). This could be due to the fact that treatments TM1 and TM2 in the 5th and 6th weeks were when the

ducks began receiving supplementary Soybean pomace, and they had not yet adapted to the new feed type. As a result, the feed absorption ability was not optimal, leading to lower weight gain compared to TM0, which was fed 100% mixed feed.

By the 8th week, the weight gain of treatment TM1 (35.48 g/duck/day) was lower than that of the other treatments, TM0 (35.51 g/duck/day) and TM2 (38.66 g/duck/day), and

this difference was statistically significant at ($P \leq 0.05$). This may be because, at this stage, some ducks in treatment TM1 were not in good health, which affected their ability to absorb feed and, consequently, their weight gain.

From the 9th to the 12th week, the highest weight gain was in treatment TM1 (57.24 - 66.70 g/duck/day), compared to the two other treatments, TM0 (50.77 - 57.99 g/duck/day) and TM2 (54.09 - 62.92 g/duck/day), and this difference was statistically significant at ($P < 0.05$). This result could be explained by the soybean pomace supplemented 15% into the mixed feed, which met the nutritional needs and was suitable for the fiber content in the diet, stimulating the ducks in TM1 gain more weight than those in TM0 and TM2.

The weight gain in the final stage of the Muscovy ducks from weeks 5-12 (g/duck/day) was 32.78, 36.40, and 33.89, respectively, for TM0, TM1, and TM2 with ($P \leq 0.05$). These results are higher than those in the experiment by Nguyen Thuy Linh *et al.* (2020) on local Muscovy ducks in the 9th to 12th weeks, which

had a weight gain (g/duck/day) of 12.5, 13.3, 15.5, and 17.1. In Nguyen Thuy Linh's (2017) experiment with a 17% CP experimental diet, the weight gain in the Lys 0.7 treatment was 14.3 g/duck/day, and in the Lys 1.1 treatment, it was 21.6 g/duck/day. This can be explained by the fact that the ducks in our experiment were fed a basal mixed feed with 19% CP, while the soybean pomace supplemented into the mixed feed diet had 19.7% CP. Therefore, the ducks in our experiment showed higher weight gain than in Nguyen Thuy Linh's (2017) experiment. The differences in these results may also be due to differences in the duck strain, as well as differences in care, management, and the experimental feed used, leading to lower results in Nguyen Thuy Linh's experiment.

Feed consumption and feed conversion ratio

Feed consumption was the amount of feed ducks eat in a day and night calculated by the amount of feed fed minus the number of leftovers. The feed consumption of ducks through the stages is shown in Table 4.

Table 4. Feed consumption (g/duck/day) of Muscovy ducks over weeks of age and feed conversion ratio

Week of age	Treatment			SE	P
	TM0	TM 1	TM 2		
5	53.22 ^a	50.38 ^b	48.81 ^b	3.82	0.00
6	69.61	66.35	63.31	2.61	0.08
7	90.57 ^a	83.26 ^c	86.23 ^b	5.42	0.00
8	112.10 ^a	110.50 ^a	106.00 ^b	4.87	0.00
9	142.70 ^{ab}	142.20 ^b	143.90 ^a	3.12	0.02
10	184.80 ^{ab}	185.10 ^a	183.30 ^b	3.78	0.03
11	236.00 ^b	239.30 ^a	239.90 ^a	4.15	0.00
12	256.00 ^b	259.90 ^a	261.30 ^a	4.04	0.00
AVG	144.58 ^a	141.60 ^b	140.64 ^b	5.28	0.03
FCR	4.41 ^a	3.89 ^c	4.15 ^b	7.78	0.02

Note: Treatment 0: (100% Mixed feed); Treatment 1: (15% Soybean pomace and 85% Mixed feed); Treatment 2: (30 Soybean pomace and 70% Mixed feed). ^{a,b,c}Data from the same row that share at least one symbol are not different at $P < 0.05$.

The results in Table 4 show that, in the 5th week, the feed consumption in TM0 (53.22 g) was higher than in TM1 (50.38 g) and TM2 (48.81 g), and the differences between the treatments

were statistically significant ($P \leq 0.05$). This is because the 5th week marked the beginning of the experiment, so the ducks in TM1 and TM2 were still adapting to the experimental

feed, which was soybean pomace, and ate less compared to TM0, which was fed 100% mixed feed.

In the 7th and 8th weeks, feed consumption in the treatments increased gradually with age, and TM0 still had higher feed consumption than TM1 and TM2. This is because, at this stage, the ducks have higher nutritional needs for muscle and feather growth, so they consume more food. However, the weight gain of TM0 in the 7th and 8th weeks was only higher than TM1 but not higher than TM2. This is because some ducks in TM1 were not in good health during this period, which affected their feed consumption compared to TM0 and TM2.

By the 9th week, feed consumption in TM2 (143.90 g) was higher than in TM0 (142.70 g) and TM1 (142.20 g). However, there was no statistically significant difference between TM2 and TM0 ($P \geq 0.05$), but TM1 was different. This difference is because the ducks in TM1 were stabilizing in health and returning to normal development.

By the 12th week, the highest feed consumption was in TM2 (261.30 g) and TM1 (259.90 g), while the lowest consumption was in TM0 (256.00 g). This difference was statistically significant ($P \leq 0.05$). At this stage, the weight gain of TM1 (66.70 g/duck/day) and TM2 (62.92 g/duck/day) was higher than TM0 (57.99 g/duck/day), so the feed consumption of TM1 and TM2 was also higher than that of TM0.

Regarding the feed conversion ratio (FCR) of the Khaki Campbell ducks from 5-12 weeks, the values were 4.41, 3.89, and 4.15 for TM0, TM1, and TM2, respectively. These results are lower than those in the experiment by Nguyen Thuy Linh *et al.* (2020) on local Muscovy ducks from 9-12 weeks, with FCR values of 7.06, 6.42, and 5.21. This difference can be explained by the fact that the ducks in our experiment were fed a basic mixed feed with 19% CP, while the soybean pomace used to replace the mixed feed had 19.7% CP. Therefore, the experimental ducks consumed less feed but had higher weight gain, resulting in a lower FCR.

Conclusions and recommendations

Based on the research results obtained, it was concluded that the weight gain during the experiment (weeks 5-12) was significantly higher in the TM1 treatment (47.19 g/duck/day) ($P < 0.05$), compared to the two other treatments, TM0 (46.55 g/duck/day) and TM2 (45.75 g/duck/day). The FCR value of the TM1 treatment (3.89) was better than the two other treatments, TM2 (4.15) and TM0 (4.41) ($P < 0.05$). Therefore, a level of 15% soybean pomace mixed with 85% mixed feed in the diet gave higher growth performance and better feed efficiency of Muscovy ducks.

References

- AOAC. 1990. Official Methods of Analysis, 15th edition. Association of the Official Analytical Chemists, Washington D.C.
- Farhat, A., Normand, L., Chavez, E.R. and Touchburn, S.P. 1998. Nutrient digestibility in food waste ingredients for Pekin and Muscovy ducks. Canada: Department of Animal Science, Macdonald Campus of McGill University, Poultry science, volume 77, Issue 9, September 1998.
- Hua Long Son. 2022. Effectiveness of the French Khaki Campbell duck farming model for meat production using probiotics. An Giang: Tan Chau Town Agricultural Extension Station.
- Minitab. 2020. Minitab reference manual release 20.1. Minitab Inc.
- Nguyen Thi Kim Dong. 2009. The effect of supplementing soybean meal in the diet on growth, nutrient digestibility, and economic efficiency of crossbred rabbits. Journal of Science, Can Tho University. Issue 11b, pp. 51-59.
- Nguyen Thuy Linh, Nguyen Thi Kim Dong, Nguyen Van Thu and Nhan Hoai Phong. 2020. The effect of crude protein levels in the diet on weight gain and meat productivity of Khaki Campbell ducks. Hanoi: Science and Technology Publishing House for Animal Husbandry. Issue 259, September 2020.
- Nguyen Thuy Linh. 2017. The effect of different levels of Lysine and energy (ME) on apparent digestibility, weight gain, and meat quality of local Khaki Campbell ducks from 5 to 12 weeks of age. Tra Vinh: Tra Vinh University Publishing House.

Opponent: Prof. Nguyen Thi Kim Dong