



Influence of Minimum Energy and Protein Levels in the Diet on Growth, Yield, and Meat Quality of Sin Cheng Duck Raised for Meat at 1-12 Weeks of Age

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ARTICLE INFO	ABSTRACT
Published Online: 25 February 2023	Research evaluating the effect of energy levels and minimum dietary protein on growth, performance, and meat quality of Sin Cheng ducks reared for meat at 1-12 weeks of age to find out energy and minimal protein levels for raising Sin Cheng ducks. The study was conducted on 450 Sin Cheng ducks from 1 day old to 12 weeks old arranged in 3 groups with different levels of protein and energy in the diet, corresponding to 3 age stages (0-3 weeks old), 4-7 weeks old, 8-12 weeks old) respectively: Control group (DC): 2267 - 2329 - 2372Kcal, 17 - 15 - 14% protein; Experimental group one (TN1): 2533 - 2640 - 2711Kcal, 19 - 17 - 16% protein; Experimental group two (TN2): 2001 - 2019 - 2033Kcal, 15 - 13 - 12% protein. Research results at week 12 showed that: With the energy and protein levels in the TN1 group giving the highest survival rate, the cumulative growth reached 2403.15 g/individual (duck), equivalent to the DC (2402.02 g/individual (duck) and higher than TN2 group (2303.03 g/individual). The percentage of carcass, breast, and thigh meat in the DC (69.73%, 16.62%, and 14.14%, respectively) was similar to that of the TN1 group (70.00%, 16.64% and 14.13% respectively) and much higher than TN2 group (66.3%, 15.62%, and 13.23%, respectively). The percentage of dry matter and protein in Sin Cheng duck's breast meat and thigh meat in the DC and TN1 groups was similar and significantly higher than in the TN2 group. The energy and protein levels in the TN1 group (2533 - 2640 - 2711Kcal, 19 - 17 - 16%) are the minimum energy and protein levels suitable for raising Sin Cheng ducks.
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KEYWORDS: Sin Cheng duck (Duck); minimal protein and energy; the survival rate of Duck; Cumulative growth of Duck, quality of Duck meat.	

INTRODUCTION

Sin Cheng duck is a famous indigenous duck breed of Lao Cai province, ducks are raised locally with extensive breeding methods as the main, supplementary food for ducks that utilize and are salvaged mainly from natural resources of local food. Some of the quality advantages of the duck are delicious, sweet meat, the carcass ratio, the percentage of thigh meat, and the percentage of breast meat of male and female ducks are 69.32 - 70.11%, respectively. 14.07 - 13.27% and 17.11 - 16.01% (Bui Huu Doan et al., 2017)[1]. Sin Cheng duck also has the advantage of being easy to raise, having good resistance, high survival rate of over 96% Nguyen Thi Thuy Van et al., (2018)[2] but low duck weight and slow growth, rearing time prolonged, 12 weeks old only reach 1.93 - 2.02kg/individual

(duck) (Pham Van Son., 2020)[3] and it is difficult to develop large numbers of herds; The use of processed industrial feed is a highly effective solution to improve the productivity of Sin Cheng ducks, but the high cost of feed is not suitable for the economic conditions of the people, this solution is difficult to apply locally, where locally available feeds are mainly corn and rice that have not been formulated into diets with appropriate minimum levels of energy and protein. Therefore, finding the minimum level of energy and protein in the appropriate diet for Sin Cheng ducks for meat production to achieve maximum growth rate while taking advantage of locally available feed sources, at low cost. This is an important job to help improve livestock production efficiency, contributing to the

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development and economic growth of ethnic minorities in remote areas.

Stemming from the above practice, we conducted a study on “the influence of the minimum dietary energy and protein levels on the growth, yield and meat quality of Sin Cheng ducks raised for meat in Lao Cai province, Vietnam. ” to determine the minimum energy and protein levels appropriate for the period 1 day old to 12 weeks old of Sin Cheng duck.

2. RESEARCH OBJECTS AND METHODS

2.1. Research Objects

Sin Cheng duck originated in Sin Cheng commune, Si Ma Cai district, Lao Cai Province, Viet Nam.

Nurturing and caring mode:

Stage (weeks old)	The density breeding (number of individuals/m ²)	Ratio cock/hen	Feeding Mode	Breeding form
01 day old - 4 weeks old	15-20	raise both cocks and hens together	Eat freely	Breeding locked up fully
5 – 8 weeks old	5-15			Combining breeding locked up and release in the playground
9- 12 weeks old	4-5			

Ducks are raised in locking up with a bath, applying the breeding process of the Institute of Livestock Production (Viet Nam). Ducks are free to eat 6 meals/day (6-22 hours), and each group was fed a separate diet (the control group was fed with the energy level in the diet as recommended by the Institute of Livestock Production).

Target watching: The research indicators included: survival rate (%), cumulative growth (g/individual), feed consumption (g/individual/day), yield, and meat quality.

2.5. Data processing

Data were collected and processed using Excel and GLM software programs in Minitab 14.

3. RESULTS AND DISCUSSION

3.1. Survival rate

The monitoring results on survival rates in Table 3.1 showed that: Sin Cheng ducks in the experiment had a high

2.2. Place and time of research

Research location: Thai Nguyen University - Lao Cai Campus
Implementation period: from February 2022 to July 2022

2.3. Research content

Determining the effect of minimum dietary energy and protein levels on growth, performance, and meat quality of Sin Cheng ducks raised for meat at 1-12 weeks of age.

2.4. Research Methods

* *Experimental arrangement:* The experiment was arranged in 3 experimental groups, each group of 50 ducks (individual), repeated 3 times. Experimental ducks were selected from ducks that hatched on time, were healthy, and were purebred. The experimental culture period started from 1 day of age to the end of 12 weeks of age.

survival rate. At the end of the experiment at 12 weeks of age, the survival rate reached 97.33% - 98.37%. In which, the TN1 group had the highest survival rate of 98.37%, equivalent to the DC group (98.00%) and higher than the TN2 group (97.33%), the error was statistically significant $p < 0.05$.

Do Ngoc Ha et al (2019) [5] showed that the Co Lung duck (Thai Nguyen province, Vietnam) – a native duck breed has a survival rate of 95.33%; Dutch ducks raised in Tien Giang province (Viet Nam) from 0 to 8 weeks old have a survival rate of 96.0-97.7% (Hoang Tuan Thanh et al., 2016)[4]. Thus, the Sin Cheng duck in our experiment has a higher survival rate than other native duck breeds. According to some other studies on Sin Cheng ducks published by Bui Huu Doan et al., 2017)[1] the survival rate was 95.5% (Sin Cheng ducks at 1-12 weeks of age); of Pham Van Son.,2020)[3] was 95.56 – 96.67% with semi-grazing and 96.67 - 97.78% with captive breeding. So, compared with the above study authors, our research results on Sin Cheng ducks have a higher survival rate.

Table 3.1. The survival rate of Sin Cheng duck

Unit: %

Weeks of age	Control group (DC group) (n = 150)	Experimental group one (TN 1 group) (n = 150)	Experimental group two (TN 2 group) (n= 150)
0-4	98,00 ±0,57	98,37±0,66	97,33±0,57
4-8	100 ±0,00	100 ±0,00	100 ±0,00
8-12	100 ±0,00	100 ±0,00	100 ±0,00
The whole stage	98.00	98.37	97.33

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3.2. Cumulative growth

Table 3.2. Body weight of experimental Sin Chéng duck (g/individual)

Unit: g/individual

Weeks of old	DC group (n = 150)	TN1 group (n = 150)	TN2 group (n= 150)	P
	Mean ± SE	Mean ± SE	Mean ± SE	
1 day old	45,21±0,02	45,26±0,03	45,19±0,02	0,268
2	356,21±0,00	357,11±0,02	355,56±0,13	0,07
4	909,24±0,54	919,54±1,41	907,83±0,41	0,06
6	1556,53 ^a ±0,32	1559,92 ^a ±0,37	1514,21 ^b ±0,04	0,04
8	2016,43 ^a ±8,69	2020,76 ^a ±7,55	1914,70 ^b ±7,32	0,02
10	2267,92 ^a ±2,78	2270,06 ^a ±2,03	2147,3 ^b ±3,31	0,02
12	2402,02 ^a ±2,68	2403,15 ^a ±0,37	2303,03 ^b ±2,73	0,01

Note: In the horizontal row, the average number with different letters, there is a statistically significant difference ($p < 0.05 - 0.001$).

Table 3.2 shows that: At the end of the experiment at 12 weeks of age, the cumulative growth of the DC group reached 2402.02 g/individual, equivalent to that of the TN1 group of 2403.15 g/ individual and higher than that of the TN2 group of 2303.03. g/individual, the error is statistically significant, $p < 0.05$.

Research by Nguyen Thuy Linh et al., 2020[6] on the levels of crude protein in the diet at levels 14, 15, 16, and 17% CP affecting the growth performance of Siamese ducks, the results show that: At 9-12 weeks of age, local Siamese duck diets had a crude protein level of 17% for increased weight gain, final weight, and carcass composition.

Compared with the results of some other studies on the growth of Sin Cheng ducks (fat duck), the weight of ducks at 12 weeks of age in all 3 of our experimental groups was higher, specifically in Pham Van' Son's study (2020)[3], the weight of

ducks at 12 weeks of age is only 1.93 - 2.02kg/individual for semi-grazing. In the study of Hoang Thanh Hai (2015)[7] Sin Cheng hens and cock at 12 weeks of age weighed 1446.60g/individual and 1692.81g/individual, respectively, when the ducks were grazing freely and searching for themselves to get food. Thus, our study shows that when ducks are provided with adequate feed, the proportion of crude protein in the feed is 17% CP (at 0-3 weeks of age), and 15% CP (at 4-7 weeks of age).) and 14% CP (at 8-12 weeks of age) significantly increased duck weight.

3.3. Meat productivity and quality

The meat productivity of Sin Chéng duck was surgery at 12 weeks of age. The results of slaughtering and surveying Sin Cheng ducks raised for meat at 84 days old are presented in Table 3.3.

Table 3.3: Results of a survey of experimental ducks

Target	DC group	TN1 group	TN2 group	P
Live weight (g)	2485±0,4	2490±0,4	2383±0,4	0,17
Mass of carcass (g)	1733±0,6	1743±0,6	1581±0,6	0,32
Percentage of carcass meat (%)	69,73 ^a ±0,3	70,00 ^a ±0,3	66,34 ^b ±0,3	0,02
Percentage of breast meat (%)	16,62 ^a ±0,04	16,64 ^a ±0,04	15,12 ^b ±0,04	0,01
Percentage of thigh meat (%)	14,14 ^a ±0,2	14,13 ^a ±0,2	13,23 ^b ±0,2	0,02
Percentage of belly fat (%)	1,83±0,006	1,72±0,006	1,70±0,006	0,06

Note: In the horizontal row, the average number with different letters, there is a statistically significant difference ($p < 0.05 - 0.001$).

Our survey results are shown in Table 3.3, showing that the percentage of the carcass, breast, and thigh meat in the DC group (69.73%, 16.62%, 14.14%, respectively)) is equivalent to the TN1 group (70.00%, 16.64%, 14.13%, respectively) and much higher than TN2 group (66.3%, 15.62%, 13.23%,

respectively), the error is statistically significant, $p < 0.05$. The percentage of belly fat of Sin Cheng ducks was similar between the experimental groups.

According to Pham Van Son et al, (2020)[3] showed that cock ducks at 12 weeks of age had carcass weights of

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1627.63 to 1692.22g, accounting for 68.10 - 68.77% in both rearing methods; the percentage of thigh meat accounted for 12.66 to 13.29%; the percentage of breast meat accounted for 14.55% to 14.81%. In hens ducks, carcass weight reached 1390.25 to 1496.43g; the percentage of carcass meat accounted for 68.24 to 68.33%, the percentage of thigh meat accounted for 12.37 to 13.19%, the percentage of breast meat was 14.26 - 14.76%; The fat percentage of cock ducks is from 0.56 to 1.70% and is from 0.63 to 1.84% of hens duck. Thus, the results of the survey of Sin Cheng ducks in this study in the control group and TN1 group had a higher percentage of carcass and breast meat.

To evaluate the meat quality of Sin Cheng duck, we have presented the survey results shown in Table 3.4. Specifically: the percentage of dry matter (DM), protein in breast meat (BM), and thigh meat (TM) of Sin Cheng duck

in the control group (DM: 19.86-25.82% (BM); 24.53-25.66% (TM); protein: 17.48-22.64 % (BM); 19.62-19.75% (TM)) and TN1 group (DM: 19.80-25.79% (BM); 24.51-25.61% (TM); protein: 17.46-22.63% (BM); 19.68-19.70% (TM)) are similar and much higher than TN2 group (DM: 18.55-24.16%) (BM); 23.10-24.12% (TM); protein: 16.63-20.71% (BM); 17.34-19.54% (TM)). The lipid content of breast meat and thigh meat of Sin Cheng duck reared in the control group (BM: 1.33-1.39%; TM: 3.71 - 4.43%) was higher than that of the TN1 group (BM :0, 96-1.12%; TM: 3.10-3.99%) and TN2 group (BM: 0.95-1.01%; TM: 3.08-3.94%), significant error statistic $p < 0.05$. The remaining parameters are similar between experimental groups, the error is not statistically significant, $p > 0.05$.

Table 3.4. Some meat quality parameters of Sin Cheng duck in 3 experimental groups

Target	Position	Control group		TN1 group		TN2 group	
		Cock (n=3)	Hen (n=3)	Cock (n=3)	Hen (n=3)	Cock (n=3)	Hen (n=3)
Dry matter (%)	L	25,82 ^A ±0,02	19,86 ^a ±0,01	25,79 ^A ±0,05	19,80 ^a ±0,02	24,16 ^B ±0,07	18,55 ^b ±0,02
	Đ	25,62 ^A ±0,04	24,53 ^a ±0,04	25,61 ^A ±0,05	24,51 ^a ±0,06	24,12 ^B ±0,08	23,10 ^b ±0,09
Protein (%)	L	22,64 ^A ±0,01	17,48 ^a ±0,03	22,63 ^A ±0,01	17,46 ^a ±0,01	20,71 ^B ±0,01	16,63 ^b ±0,03
	Đ	19,62 ^A ±0,01	19,75 ^a ±0,12	19,68 ^A ±0,02	19,70 ^a ±0,03	17,34 ^B ±3,22	19,54 ^b ±0,05
Lipit (%)	L	1,39 ^A ±0,001	1,33 ^a ±0,002	1,12 ^B ±0,001	0,96 ^b ±0,001	1,01 ^B ±0,001	0,95 ^b ±0,001
	Đ	4,43 ^A ±0,001	3,71 ^a ±0,002	3,99 ^B ±0,004	3,10 ^b ±0,001	3,94 ^B ±0,002	3,08 ^b ±0,001
Minerals (%)	L	1,26±0,001	1,33±0,001	1,26±0,001	1,33±0,001	1,25±0,001	1,27±0,003
	Đ	1,03±0,001	1,11±0,001	1,04±0,001	1,09±0,00	1,03±0,001	1,08±0,001
Preservation dehydration rate (%)	L	1,14±0,001	3,19±0,02	1,13±0,001	3,19±0,002	1,13±0,001	3,17±0,001
	Đ	0,95±0,002	2,68±0,004	0,97±0,001	2,66±0,004	0,96±0,001	2,62±0,001
Processing dehydration rate (%)	L	33,30±0,001	34,31±0,11	33,27±0,16	34,29±0,27	33,25±0,14	34,28±0,26
	Đ	27,74±0,001	32,91±0,12	27,70±0,03	32,85±0,32	27,66±0,12	32,84±0,57
pH15	L	5,34±0,002	5,30±0,007	5,28±0,001	5,30±0,006	5,24±0,09	4,94±0,002
	Đ	5,36±0,001	5,28±0,001	5,34±0,001	5,29±0,005	5,46±0,003	5,26±0,004
pH24	L	5,61±0,002	5,62±0,001	5,63±0,002	5,61±0,001	5,63±0,005	5,62±0,006
	Đ	5,73±0,005	5,73±0,04	5,74±0,004	5,74±0,007	5,73±0,002	5,76±0,005
Light colour (L*)	L	42,13±0,12	42,68±0,24	42,15±0,51	42,64±0,33	42,14±0,24	42,66±0,12
	Đ	45,46±0,11	45,95±0,38	45,56±0,27	45,95±0,35	45,57±0,44	46,94±0,23
Red (a*)	L	18,21±0,03	18,63±0,07	18,24±0,09	18,64±0,08	18,18±0,12	18,57±0,05
	Đ	19,68±0,05	19,53±0,03	19,61±0,05	19,54±0,06	19,55±0,06	19,52±0,06
Yellow (b*)	L	6,28± 0,04	6,47± 0,002	6,24± 0,004	6,45± 0,01	6,22± 0,001	6,43± 0,007
	Đ	7,11± 0,02	7,24± 0,01	7,15± 0,001	7,23± 0,02	7,13± 0,002	7,22± 0,004
Toughness (N)	L	3,02±0,001	3,05±0,006	3,07±0,002	3,06±0,001	3,11±0,001	3,07±0,003
	Đ	3,49±0,004	3,74± 0,003	3,48±0,004	3,77± 0,001	3,51±0,001	3,75±0,002

Note: In the horizontal row, the average number with different letters, there is a statistically significant difference ($P < 0,05$)

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The results of the survey on the quality of Sin Cheng duck meat in Table 3.4 show that: the percentage of dry matter and protein in the breast meat and thigh meat of Sin Cheng duck in the control lot (DM: 19.86-25.82% (BM)); 24.53-25.66% (TM); protein: 17.48-22.64 % (BM); 19.62-19.75% (TM)) and TN1 group (DM: 19.80-25.79% (BM); 24.51-25.61% (TM); protein: 17.46-22.63 % (BM); 19.68-19.70% (TM)) were similar and high much better than TN2 group (DM: 18.55-24.16% (BM); 23.10-24.12% (TM); protein: 16.63-20.71% (BM); 17.34-19.54% (TM)). The lipid content of breast meat and thigh meat of Sin Cheng duck reared in the control group (BM: 1.33-1.39%; TM: 3.71 - 4.43%) was higher than that of the TN1 group (BM :0, 96-1.12%; TM: 3.10-3.99%) and TN2 group (BM: 0.95-1.01%; TM: 3.08-3.94%), significant error statistic $p < 0.05$. The remaining parameters are similar between experimental groups, the error is not statistically significant, $p > 0.05$.

4. CONCLUSION AND RECOMMENDATION

4.1. Conclusion

The energy and protein levels in the TN1 group gave the highest survival rate, the cumulative growth reached 2403.15 g/individual, equivalent to the control group (2402.02 g/individual) and higher than the TN2 group (2303.03 g/individual). The percentage of carcass, breast, and thigh meat in the control group (69.73%, 16.62%, and 14.14%, respectively) was similar to that of the TN1 group (70.00%, 16.64% and 14.13% respectively) and much higher than TN2 group (66.3%, 15.62%, 13.23%, respectively). The percentage of dry matter and protein in the breast meat and thigh meat of Sin Cheng duck in the control group (DM: 19.86-25.82% (BM); 24.53-25.66% (TM); protein: 17.48-22.64 % (BM); 19.62-19.75% (TM)) and TN1 group (DM: 19.80-25.79% (BM); 24.51-25.61% (TM); protein: 17.46-22.63 % (BM); 19.68-19.70% (TM)) equivalent and much higher than TN2 group (DM: 18.55-24.16% (BM); 23.10-24.12% (TM); protein: 16.63-20.71% (BM); 17.34-19.54% (TM)). The lipid content of breast meat and thigh meat of Sin Cheng duck reared in the control group (BM: 1.33-1.39%; TM: 3.71 - 4.43%) was higher than that of the TN1 group (BM :0, 96-1.12%; TM: 3.10-3.99%) and TN2 group (BM: 0.95-1.01%; TM: 3.08-3.94%). Thus, the energy and protein levels in the TN1 group (2533 - 2640 - 2711Kcal, 19 - 17 -16%) are the minimum levels of energy and protein suitable for raising Sin Cheng ducks.

4.2. Recommendation

Using the feed formulation with the minimum energy and protein content in the TN1 group to mix as a diet for Sin Cheng ducks contributes to reducing feed costs while ensuring stable yield and quality.

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