How to Cite:
Phan, K. N., Tran, T. S., & Tran, V. G. (2022). Research on possible growth and meat quality of lac thuy chicken in the form of semi-grazing in Gia Lai, Viet Nam. *International Journal of Health Sciences*, *6*(S3), 6236–6244. https://doi.org/10.53730/ijhs.v6nS3.7379

Research on possible growth and meat quality of lac thuy chicken in the form of semi-grazing in Gia Lai, Viet Nam

Kieu Ngu Phan
Quy Nhon University, Quy Nhon city, 49000, Vietnam

Thanh Son Tran
Quy Nhon University, Quy Nhon city, 49000, Vietnam

Van Giang Tran
University of Education, Hue University, Hue city, 49000, Vietnam
*Corresponding author: Email: tranvangiang@dhsphue.edu.vn, tvgiang@hueuni.edu.vn

***Abstract*---**The study was carried out with 120 Lac Thuy chickens housed in form of semi-grazing in the An Khe, Gia Lai, to determine their possible growth and meat quality from 0 - 16 weeks of age. The results show that the survival rate of Lac Thuy chickens has been gradually decreasing since hatching to 5 weeks old, and this rate has stabilized to 16 weeks old at 93,33%. The cumulative growth at 16 weeks old in experiment 1 was 1.383 - 1.389 kg/individual, in experiment 2 was 1.538 - 1.546 kg/individual. The absolute growth in experiment 1 was 12.06 - 12.12 g/individual/day, in experiment 2 was 13.45 - 13.52 g/individual/day. The carcass ratio was 64.73 - 67.36%, the breast meat ratio was 15.92 - 19.33%, and the thigh meat ratio was 23.68 - 25.49%. The dehydration rate after processing at 24h is 17.35 - 21.25%, at 48h is 18.39 - 26.45% The dehydration rate after preservation at 24h was 1.04 - 1.78%, at 48h was 0,97 - 1.83%. pH value of breast muscle after slaughter for 15 minutes was 5.93 - 6.11, after preservation at 24 hours was 5.79 - 5.89 and after 48 hours of storage was 5.63 - 5.74; toughness of meat at the time of 24h was 21.10 - 23.69 kg/cm2, at the time of 48h was 18.39 - 26.45 kg/cm2, bright, beautiful flesh color at 24h was 51.85 - 55.79, and at 48h was 53.58 - 56.80.

***Keywords*---**growth, lac thuy chicken, meat quality.

Introduction

Animal husbandry is an important sector in the structure of Vietnam's agricultural, which is highly profitable and has potential for development. In which, chicken raising has a long tradition, growing strongly in both scale, productivity and quality. The goal from 2010 to 2020 is to develop livestock production in the direction of farms, industry and controlled grazing (raised and semi-grazing), the total number of chickens will increase by 5% per year, and by 2020 it will reach about 300 million heads [1, 10]. Currently, in addition to high-yielding industrial-oriented chicken breeds, indigenous chicken breeds are also increasingly interested and focused on investment and development. One of the chicken breeds that is well adapted to environmental conditions, with good tolerance and good meat quality is the Lac Thuy chicken [8, 11]. This chicken breed has good growth ability, delicious and chewy meat suitable for Vietnamese consumers, was domesticated and preserved at the Institute of Livestock Production in 2014 and mass-raised in 2006. For supplementing precious chicken breeds and assessing the degree of adaptation to the ecological conditions, especially the influence of temperature and humidity of the rearing environment on survival rate, growth ability and meat quality, the chickens were reared with animal feed in semi-grazing conditions in An Khe town, Gia Lai province.

Research Materials and Methods

Farmhouses and Experimental Chickens: The study was conducted on purebred Lac Thuy chickens (Hoa Binh province), one day old, imported from the hatchery of the Center for Animal Experimentation and Conservation, National Institute of Livestock Production. Growth study: A total of 120 1-day-old chicks were experimentally raised to 16 weeks of age to monitor the survival rate, growth, yield and quality of chicken meat in An Khe town, Gia Lai province. Chickens were arranged experimentally including 4 lots, using different feeds with the following ingredients:

A total of 120 one-day-old Lac Thuy chicks were evenly distributed into 4 lots and 2 replicates (I and II). Each replicate consisted of two treatments corresponding to two batches: (1) the batch of chickens fed with self-composting feed and (2) the batch of chickens fed with commercial feed (Food). In this study, there are: I consists of two lots: Lot 1 and Lot 2 (Feed); II consists of two lots: Lot 3 and Lot 4 (Food). Each experimental batch consisted of 30 animals. In addition to the difference in food, other factors, such as density (10 - 15 fish/m2 of barn floor, garden ≥ 1m2/head) and feeding process (feeding depending on age, twice a day) were also taken into account. The veterinary care were followed according to current guidelines with adequate drinking water in the experimental batches.

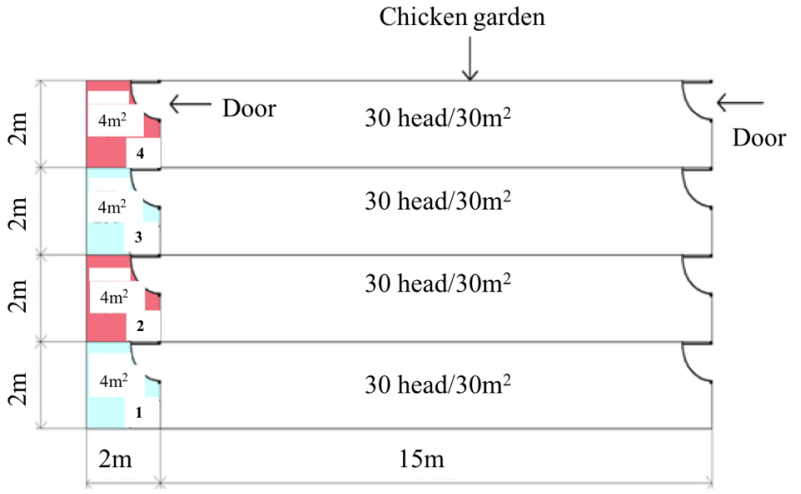

Figure 1. Experimental arrangement for growth study of Lac Thuy chickens in Gia Lai province from 1 day old to 16 weeks old

Research Methods: Determination of growth potential

Survival rate: The survival rate is determined by the percentage of individuals alive at the end of the period compared to the number of individuals present at the beginning of the period: Survival rate (%) = (Number of animals alive at the end of the period/Number of animals at the beginning of the period) × 100.

The ability to grow

Cumulative growth: Chickens were weighed weekly in the morning before feeding and drinking. Weigh them one by one, using a dedicated scale. From the weight of each individual, calculate the weekly weight gain (unit: grams/head). Absolute growth: A = (P2 – P1)/(T2 – T1). In which: A is the absolute growth (gram/head/day); T1 is the time of the previous survey (date of age); T2 is the time of the following survey (date of age); P1 is the body weight at the time T1 (g); P2 is the body weight at the time T2 (g) [3].

Survey on yield and quality of meat

Possibility of meat production: At the end of the rearing period at 24 weeks of age, 3 hens in plot 1 and 3 hens in plot 2 were slaughtered to assess the meat-producing ability. The surveyed individuals had a weight that fluctuated around the average value of the experimental chicken flock. Chickens were kept separately for one day, before which, food was not given and only water was provided. The criteria for evaluating carcasses are live weight, carcass weight, carcass percentage, thigh meat weight, thigh meat percentage, breast meat weight and breast meat percentage.

Carcass Ratio: $\text{Carcass Ratio} = \frac{\text{Carcass weight}}{\text{live mass}}\ x\ 100$

Ratio of thigh meat: $\text{Weight of left thigh meat} = \frac{\text{Weight of left thigh meat x 2}}{\text{Carcass weight}}\ x\ 100$

Breast meat ratio: $\text{Breast meat ratio} = \frac{\text{Weight of left breast meat x 2}}{\text{Carcass weight}} \; x \; 100$

Survey of meat quality: The indicators are determined according to the method of Schilling MW *et al* (2008) [5]: The studied indicators include: body pH; rate of dehydration after 24 hours and 48 hours of storage and processing; toughness of meat and meat color. The data were processed using MS Excel 2010 software with a significance level of α = 0.05. The statistical analyzes were tested for significant difference (no data representation).

Results and Discussion

The survival rate of Lac Thuy chickens

The survival rate is influenced by external factors and the quality of the breeding stock. Especially in the period of 0 - 4 weeks old. Chickens are affected by the quality of the breed, the care regime and especially the temperature regime of the cage. By monitoring the survival rate of Lac Thuy chickens raised in An Khe town, Gia Lai province, we obtained the following results:

Table 1
Survival rate of Lac Thuy chickens raised in An Khe town, Gia Lai province from 1 day old to 16 weeks old

Time	Lot 1		Lot 2		Lot 3		Lot 4	
Weeks of age	Number	Survival rate	Number	Survival rate	Number	Survival rate	Number	Survival rate
New-born	30	100	30	100	30	100	30	100
1	29	96.67	29	96.67	29	96.67	30	100
2	28	93.33	29	96.67	29	96.67	29	96.67
3	28	93.33	28	93.33	29	96.67	29	96.67
4	28	93.33	28	93.33	28	93.33	29	96.67
5	27	90	28	93.33	28	93.33	29	96.67
6	27	90	28	93.33	28	93.33	29	96.67
7	27	90	28	93.33	28	93.33	29	96.67
8	27	90	28	93.33	28	93.33	29	96.67
9	27	90	28	93.33	28	93.33	29	96.67
10	27	90	28	93.33	28	93.33	29	96.67
11	27	90	28	93.33	28	93.33	29	96.67
12	27	90	28	93.33	28	93.33	29	96.67
13	27	90	28	93.33	28	93.33	29	96.67
14	27	90	28	93.33	28	93.33	29	96.67
15	27	90	28	93.33	28	93.33	29	96.67
16	27	90	28	93.33	28	93.33	29	96.67

The total survival rate was over 96%. The survival rate to 8 weeks of age compared to the beginning of the period of plot 1 was 90%, lot 2 and lot 3 were 93.33%, lot 4 was 96.67%; up to 16 weeks of age, the survival rate of the plots was 100% compared to week 8 and 93.33% compared to the beginning of the

period. This rate is higher than the results of conservation of Lac Thuy chickens at the Institute of Livestock Production. Chickens are adequatly adapted to the conditions of the Central Highlands.

Cumulative growth of Lac Thuy chickens through weeks of age

Weight of Lac Thuy chickens at 8 weeks of age in Experiment I was: Chickens fed with self-composting food reached 587.44 g/head, chickens fed with commercial food reached 717.04 g/head; In Experiment II: Chickens fed with self-composting food gained 605.83 g/head, chickens fed with commercial food gained 698.37 g/head. At 16 weeks of age, the numbers are: 1,383.03 g/head and 1,538.74 g/head in Experiment I and 1,389.86 g/head and 1,546.19 g/head in Experiment II, repectively.

Table 2
Weight (g) of Lac Thuy chickens raised in An Khe town, Gia Lai province from 1 to 16 weeks old

Time	Experiment I		Experiment II	
Weeks of age	Lot 1	Lot 2	Lot 3	Lot 4
Weeks of age	Average	Average	Average	Average
New-bon	32.50	32.45	32.50	32.45
2	114.19±2.38^{a}	120.01±2.43^{a}	118.20±2.23^{a}	121.87±2.85^{a}
4	299.40±56.58^{a}	312.71±11.19^{a}	318.88±7.82^{a}	327.45±11.64^{a}
6	423.04±5.95^{a}	477.19±11.58^{b}	430.43±11.60^{a}	488.38±12.27^{b}
8	587.44±16.96^{a}	717.04±14.69^{b}	605.83±12.70^{a}	698.37±14.92^{b}
10	741.59±19.35^{a}	872.34±21.52^{b}	759.27±16.25^{a}	897.35±22.42^{b}
12	996.32±15.68^{a}	1130.38±21.63^{b}	999.05±16.47^{a}	1167.57±24.00^{b}
14	1225.83±24.46^{a}	1344.43±27.76^{b}	1192.85±30.03^{a}	1366.22±27.11^{b}
16	1383.03±30.07^{a}	1538.74±32.17^{b}	1389.86±27.51^{a}	1546.19±32.19^{b}

Note: Different letters in a row are statistically significant differences.

The absolute growth of Lac Thuy chickens through weeks of age: Absolute growth is a characteristic indicator for the growth process. Absolute growth is expressed by the increase in body mass in a time unit between two surveys. We monitored the changes of chicken body weight by week of age, on that basis, we calculated the absolute weight gain. The absolute growth in g/head/day of Lac Thuy chickens raised in An Khe town, Gia Lai province is determined as follows:

Table 3
Absolute growth A (g/head/day) of Lac Thuy chickens raised in An Khe town, Gia Lai province through weeks of age

Time	Experiment I		Experiment II	
	Lot 1	Lot 2	Lot 3	Lot 4
Weeks of age	g/head/day	g/head/day	g/head/day	g/head/day
0 - 2	5.84	6.25	6.12	6.39

2 - 4	13.23	13.76	14.33	14.68
4 - 6	8.83	11.75	7.97	11.50
6 - 8	11.74	17.13	12.53	15.00
8 - 10	11.01	11.09	10.96	14.21
10 - 12	18.20	18.43	17.13	19.30
12 - 14	16.39	15.29	13.84	14.19
14 - 16	11.23	13.88	14.07	12.85
0 - 16	12.06	13.45	12.12	13.52

Chickens in both experiments had low absolute growth, averaging from 1 day old to 16 weeks old, reaching less than 14 g/head/day. The growth was strongest at 10-12 weeks of age: Lot 1 was 18.20 g/head/day, Lot 2 was 18.43 g/head/day, Lot 3 was 17.13 g/head/day and Lot 4 gained the highest weight of 19.30 g/head/day.

Survey on yield and quality of meat

Meat yield: According to the research results, all the meat performance parameters of Lac Thuy chickens fed with industrial feed were higher than those of chickens fed with self-mixed feed, in which the indicators of live weight at slaughter, weight Carcass, thigh weight and thigh meat weight were different and had statistical significance ($p < 0.05$), but for other criteria, this difference was not statistically significant ($p > 0.05$). In the same batch (chickens raised with the same feed), all the meat quality parameters tested in the roosters and hens were different and had statistical significance ($p < 0.05$). In which the percentage of thigh meat of roosters is higher than that of hens, but all other parameters such as carcass ratio, percentage of edible organs, percentage of belly fat and percentage of breast meat in hens are higher than that in roosters.

Table 4
Some results on meat performance of Lac Thuy chickens raised in An Khe town, Gia Lai province at 16 weeks of age

Criteria	Chickens feed with industrial food		Chickens feed with self-mixed food	
	Male	Female	Male	Female
	Average	Average	Average	Average
Live P (g)	1617,00±78,00a	1286,00±88,83c	1495,67±16,86b	1155,00±34,07d
P carcass (g)	1086,96±61,97a	862,40±51,45c	968,08±51,73b	778,00±18,63c
P edible offal (g)	74,68±3,87a	66,93±6,62ab	73,49±5,60a	62,23±5,10b
P belly fat (g)	1,86±3,22a	13,60±18,73a	14,50±7,25a	11,80±7,42a
P rib (whole bone, skin) (g)	254,59±25,23a	223,73±30,57ab	226,62±17,31ab	207,82±11,72b
P breast meat (g)	175,96±19,77a	162,53±22,28a	154,15±14,00a	150,38±12,63a
P thigh (whole bone, skin) (g)	414,07±26,46a	311,22±23,57c	361,63±20,80b	275,37±14,96c
P thigh meat (g)	277,02±22,23a	207,95±25,23c	236,43±14,86b	184,25±2,02c
Carcass percentage (%)	67,22	67,06	64,73	67,36

Percentage of edible offal (%)	6,87	7,76	7,59	8,00
Percentage of belly fat (%)	0,17	1,58	1,50	1,52
Body rate (%)	23,42	25,94	23,41	26,71
Proportion of breast meat (%)	16,19	18,85	15,92	19,33
Thigh ratio (%)	38,09	36,09	37,36	35,39
Percentage of thigh meat (%)	25,49	24,11	24,42	23,68
Ratio of thigh meat + breast (%)	41,67	42,96	40,35	43,01

Note: In the same row, numbers with different letters are statistically significant.

Meat quality: To check the quality of meat, we have determined the pH, preservation dehydration rate, processing dehydration rate, meat toughness and meat color at two time points of 24 and 48 hours. The pH15 index (pH at 15 minutes after slaughter) reached 5.93 - 6.18, the pH24 reached 5.79 - 5.89 and the pH48 reached 5.67 - 5.78, so the chickens raised in Gia Lai province were crossbred for good quality meat. The rate of dehydration after storage of 24 hours was 1.04 - 1.78, at 48 hours was 0.97 - 1.83; the rate of dehydration after processing at 24 hours was 17.35 - 21.25, after 48 hours was 18.39 - 26.45, lower than that of Lac Thuy chicken raised in Dong Nai province (the preservation dehydration rate after 24 hours: 1.17 - 2.05, the dehydration rate after 24 hours: 18.80 - 22, 35) and the H'mong chickens raised at the experimental farm - Vietnam Academy of Agriculture (2016) (2.5 - 4.5, and 21.5 - 23.5 respectively). The toughness of experimental meat after 24 hours was 21.10 - 23.69 N/cm^2, after 48 hours was 22.66 - 23.71 N/cm^2, higher than chicken raised in Dong Nai (after 24 hours: 19.00 - 21.85 N/cm^2), but lower than that of Dong Tao chicken raised in Hung Yen (28.66 N/cm^2).

The light color (L*), red (a*), and yellow (b*) of breast muscle of Lac Thuy chicken in this study at 24h were: 51.85 - 55.79, 0 .57 - 2.78, 0.57 - 8.96, at 48 hours were 53.85 - 56.80, 0.82 - 2.41, 7.23 - 12.01, which are slightly darker and less red than the chickens raised in Dong Nai (L*= 54.8 - 55.8; a*= 4.1 - 4.2; b*= 10.3 - 12.4) and the Broiler chicken (L*= 53.75 - 55.39; a*= 0.63 - 1.92; b*= 7.66 - 9.55), and a combination of three economic hybrid chickens (Mia-Ho - Luong Phuong). The results were also somewhat brighter than the results studied on Ri chickens and crossbred Ri chickens (L*= 48.5 - 49,6) [4], [7].

Table 5
Results of some meat quality parameters of Lac Thuy chickens raised in An Khe town, Gia Lai province at 16 weeks of age

Chỉ tiêu	Chickens feed with industrial food		Chickens feed with self-mixed food	
	Male	Female	Male	Female
pH15	6,11	5,93	5,97	6,08
pH24	5,89	5,79	5,86	5,88
pH48	5,74	5,68	5,65	5,63

Dehydration rate of 24-hour storage (%)	1,48	1,78	1,04	1,58
Rate of dehydration in 48h storage (%)	1,54	1,83	0,97	1,83
24h processing dehydration rate (%)	21,03	21,25	17,35	20,70
48h processing dehydration rate (%)	23,40	22,28	18,39	26,45
Toughness 24h (N/cm2)	22,77	21,10	23,69	22,85
Toughness 48h (N/cm2)	23,47	23,71	22,91	22,66
Meat color L*24h	51,85	53,43	53,54	55,79
a*24h	2,78	1,58	1,84	0,57
b*24h	6,86	8,96	1,84	0,57
L*48h	54,27	53,85	54,44	56,80
a*48h	2,41	1,22	1,57	0,82
b*48h	8,13	10,16	12,01	7,23

Note: L: color brightness; a*: red; b*: yellow*

Therefore, the slaughter performance and meat quality of Lac Thuy chickens are similar to those of H'Mong and Egyptian chickens, but lower than those of GF 168 chickens raised in Hue. Compared to Dong Tao chicken, the pH15 is higher, the brightness is darker, the toughness is lower, and other parameters of meat quality are similar. Brightly colored chicken meat is attractive to consumers (L: 51.85 - 55.79) [8].

Conclusion

The survival rate to 16 weeks of Lac Thuy chickens in the batches raised by self-composting food was 90.00% and 93.33%; chickens fed with feed with commercial food were 93.33% and 96.67%. The average weight of chickens at 16 weeks of age in the feedlot 1 was 1,383.03 - 1,389.86 g/head and in the feedlot 2 was 1,538.74 - 1,546.19 g/head. The average absolute growth from one day old to 16 weeks old in chickens raised on by self-composting food was 12.06 - 12.12 g/chicken/day; in chickens fed with commercial food was 13.45 - 13.52 g/head/day. The percentage of carcass was: 64.73 - 67.36%, the proportion of breast meat was: 15.92 - 19.33% and the percentage of thigh meat was 23.68 - 25.49%. The rate of dehydration after processing at 24h time was 17.35 - 21.25%, at 48h time was 18.39 - 26.45%; the rate of dehydration after storage at 24 h was 1.04 - 1.78%, at 48 h was 0.97 - 1.83%; The pH value of breast muscle meat at 15 minutes after slaughter was 5.93 - 6.11, after 24 hours of storage was 5.79 - 5.89 and after 48 hours of storage was 5.63 - 5.74. The toughness of meat at 24h was 21.10 - 23.69 kg/cm^2, at 48h was 18.39 - 26.45 kg/cm^2; bright, beautiful meat color at 24h was 51.85 - 55.79, at 48h was 53.58 - 56.80.

Acknowledgments

This work was supported by Hue University under the Core Research Program, Grant No. NCM.DHH.2022.07.

References

1. Ministry of Agriculture and Rural Development (2008), Livestock Development Strategy to 2020, *Hanoi Agricultural Publishing House.* 1-125.

2. Ayodeji P. I., Oliver Z., K., Agree N., Bohani M., (2021) “Current status and intervention of South Africa chicken production”, A review. *World’s Poultry Science Journal.* 115-133. https://doi.org/10.1080/00439339.2020.1866965.
3. Bui T. A. D., Nguyen H. N., Nguyen T. L., (2013) “Some hematological characteristics of chickens with Isa Brown disease with Newcastle disease”. *Journal of Science and Development.* 11(4): 514-518.
4. Bui H. D., Huu Th., (2011a), “Production ability and meat quality of economic hybrid 3 varieties (Cane - Ho - Luong Phuong),” *Journal of Science and Development, Hanoi University of Agriculture Cabinet.* 9 (6): 941 - 947.
5. Ho X. T.,, Phan X. H., (2010), “Productivity and meat quality of Ri chicken and crossbred with Luong Phuong chicken,” *Journal of Animal Science and Technology - Livestock Institute.* 22: 13 - 19.
6. Jana P., Frank C., An C., Joris M., Dirk F., Stefaan D. S., Geert P. J. J., (2015) “Selection for Growth Performance in Broiler Chickens Associates with Less Diet Flexibility”, *Plos One.* 10(6): 1-13. https://doi.org/10.1371/journal.pone.0127819.
7. Maxine M. B.,. (1985) “Outline of Veterinary Clinical Pathology, 3 rd”, *The Iowa State University Press Ames, Iowa, U.S.A.* 45-345, 1985.
8. Nguyen D. H., Ho L. Q. Ch., Nguyen Th. M., Nguyen Th. Th., Nguyen M. H., Nguyen D. Ch., (2017), “Status of broiler farming in Hue”, *Hue University Science Review.* 126, 19 - 31.
9. Nguyen V. T., (2012) “Research on determining an economically efficient crossbreed between H'mong and Egyptian chickens to produce chicken with bones, skin, and black meat”, *Scientific Report of the Institute of Livestock Production.* 76-82.
10. Nguyen T. Q., (2008) “Research on appearance characteristics and meat production ability of F1 chickens (Hmong rooster x Egyptian hen) and F1 chicken (Hong drum x Luong Phuong hen) raised semi-grazing in Thai Nguyen”, *Agricultural Science, Thai Nguyen University.* 1-105.
11. Phung D. T., Nguyen T. M., Le T. T. H., (2004) “Results of selective breeding of some production traits of Egyptian chickens through 6 generations”, Collection of scientific reports on animal husbandry. *Agriculture Publishing House.* 90-96.
12. Suwattitanun W., Wattanachant S., (2014), Effect of various temperature and storage time during process on physical quality and water-holding capacity of broiler breast meat", *J KKU Res.* 19 (5): 628 - 635.