Veterinary Integrative Sciences 2021; 19(2): 247-257. DOI; 10.12982/VIS.2021.022

Vet Integr Sci

Veterinary Integrative Sciences

ISSN; 2629-9968 (online)

Website; www.vet.cmu.ac.th/cmvj

Research article

The comparatives of growth and carcass performance of the Thai native chicken between economic selection (Chee KKU12) and natural selection (Chee N)

Doungnapa Promket* **and Khanitta Ruangwittayanusorn**

Department of agricultural technology, faculty of technology, Mahasarakham University, Mahasarakham, 44150, Thailand

Abstract

Chee is 1 of 4 important native chicken breed in Thailand. Genetic selection can be used to improve growth and carcass performance. The objective of this study was to compare growth and carcass performance of native chickens (Chee) with a population selected for economic traits (Chee KKU12) and natural selection (Chee N). Two hundred Chee KKU12 and Chee N chickens were divided into 5 replicates, 20 chickens per replication. Record growth and carcass quality for data analysis. The results showed that at 12 weeks of age, Chee KKU12 chickens (1,279.484 g) had a higher body weight than did Chee N chickens (1,180.212 g). The averages daily weight gain at 4-6, 6-8, and 0-12 weeks of age of Chee KKU12 chicken (17.861, 19.230, and 14.843 grams) was higher than Chee N chickens (16.284, 17.497, and 13.668 g) ($P<0.05$). The carcass quality with mixed gender showed that Chee KKU12 chickens had higher breast (20.859%) and abdominal fat (0.659%) than Chee N chicken (19.585% and 0.217%, respectively) ($P<0.05$), but Chee KKU12 chicken thigh (17.007%) was significantly lower than Chee N chickens (18.627%). Regression analysis revealed that the selection of Chee KKU12 chickens for gain in weight will result in better carcass composition including wing (0.074 g), breast (0.089 g), and drumstick (0.134 g), while Chee N chicken had better thigh (0.189 g) when selected for high growth performance ($P<0.05$). It was concluded that chicken population selected for economic traits has a better growth performance in open housing conditions than naturally selected chickens.

Keywords: Native chicken, Economic selection, Natural selection

Corresponding author: Doungnapa Promket, Department of Agricultural Technology, Faculty of Technology, Mahasarakham University, Mahasarakham 44150, Thailand.Tel: + 66 896201913. E-mail: napakran@hotmail.com

Article history; *received manuscript: 9 March 2021,*
revised manuscript: 31 March 2021,
accepted manuscript: 8 April 2021,
published online: 21 April 2021
Academic editor; *Korakot Nganvongpanit*

INTRODUCTION

Native chickens play a vital role in rural households as a source of high-quality protein. The important characters are the ability to tolerate harsh environmental conditions and poor husbandry practices (Padhi, 2016). Meat of native chicken has lower content of fat and cholesterol (Jaturasitha et al., 2002; Jaturasitha et al., 2008b; Jaturasitha et al., 2016; Bungsrisawat et al., 2018). Moreover, the meat and eggs are considered rich sources of protein and iron (Haunshi et al., 2011). Chee chicken is 1 of 4 breeds upon which the Department of Livestock Development and the Thailand Research Fund have cooperated to collect breeds for genetic conservation and utilization. The characteristics of Chee are unique with white feathers around neck, body and tail, a small pea comb, skin on face of the cock and a smooth and red face (Kammongkun et al., 2015). Khon Kaen University has been jointly with the Thailand Research Fund developing Chee by selection for economic traits such as growth performance, carcass performance and egg production. The population of Chee KKU12 was selected for over 4 generations and set up the flock by inter se mating and selected on breeding values estimated by Best Linear Unbiased Prediction (BLUP). Selection index was used to select replacement male and female. The selection index composed from growth, breast width and egg production. Mean body weight at 12 weeks was 1,140 g for males and 943 g for females. Chee N is a native chicken from the Department of Livestock Development, which maintains the flock by natural selection, base population of Chee which was selected for straight characteristic breed (white feather, yellow beak and shank, peanut comb). Body weight of Chee N at 12 weeks was 1,156.55 g. Average daily gains was 13.43 g/bird/day for mixed gender.

Nowadays, consumers have an increasing demand for native chicken. Native chickens are generally raised without using antibiotics or chemicals, and thus are rendered safe and have no negative impact on human health (Funaro et al., 2014). Commercial limitations of native chickens are a lower final weight and low daily weight gain. Their low growth efficiency and poor performance is attributable to lack of proper feed, management, sanitation programs and crucially, breed. Farmers generally raise them free range with fed by hand also without breed selection it leads to inbreeding (Jaturasitha et al., 2008b). Genetic improvement of native chickens are required to achieve higher growth performance and characteristics in order to satisfy the needs of consumers. Studies to improve growth performance and selection for body weight, have shown that body weight and egg weight of the first egg were 1,623.90 ± 219.70 g and 33.76 ± 5.27 g, respectively. Number of eggs, number of chicks and %hatchability of first clutch were 10.62 ± 2.31 eggs, 7.40 ± 2.34 birds and 69.84 ± 19.92 %, respectively (Kingori et al., 2010; Haunshi et al., 2011). In addition, some studies have been carried out to improve carcass composition (Jaturasitha et al., 2008b; Fanatico et al., 2008; Funaro et al., 2014). Our previous study investigated the growth performance, carcass yields and meat quality of crossbred Chee with Broilers, Shanghai nor Shanghai-Road-Bar, the result showed that the crossbred Chee with Broilers had better growth performance (Ruangwittayanusorn et al., 2012), better carcass and meat quality (Promket et al., 2016) than with Shanghai or Shanghai-Road-Bar. Nevertheless, the selection for the true breed of native

chicken is important because of the major genes for improvement of high quality yield, disease resistance and adaptability are preserved in the native breed chicken. However, selection at a research station might have a negative effect on the adaptation to other environments. The hypothesis of this research is that economic selection (Chee KKU12) had growth and carcass performance as well as natural selection (Chee N) in open house. Therefore, the objective of this study was to compare economic selection (Chee KKU12) and natural selection (Chee N) of Chee chicken for growth and carcass performance.

MATERIALS and METHODS

Animals and management

The experiment was conducted with the approval of the Committee of the Livestock Department following the guidelines of the Federation of Animal Science Societies (1999) (document ID - U1-01065-2558). One hundred of each Chee KKU12 and Chee N chickens were divided into 5 cages, 20 chickens per replication (5 replications per group). Chee KKU12 chickens are a representative of economic selection breeds, obtained from the Network Centre for Animal Breeding and OMICS Research, Khon Kaen University. Chee N chickens are representation of natural selection breeds, obtained from the Thai Department of Livestock Development, Khon Kaen province, Thailand. All chickens were raised under the same conditions, including open house, raising 10 chickens per square meter. The light program commenced with continuous 24 hours lighting from the first day followed by a daily reduction of 1 hour until a program of 8 hours of light and 16 hours of darkness (8L:16D) was reached from 28 days to 12 weeks of age. The first four weeks of the brood are temperature controlled at 95oF and decrease every 5oF each week until the end of brooding. Both chicken groups were fed using a commercial diet of 21% CP, ME 3,050 kcal/kg for 0-4 weeks of age and 19% CP, ME 3,100 kcal/kg for 4-12 weeks of age (NRC, 1994). The feeding program from one to four weeks was ad libitum, and after four weeks, it was restricted. Water was provided ad libitum. Two native chickens from each cage were randomly selected at 12 weeks of age, with their market age. After a withdrawing period of 8 hours, the chicken was euthanized by conventional neck cut and exsanguinated for 2 minutes. The method was followed by Jaturasitha et al. (2008a). The carcasses were then manually defeathered and eviscerated.

Data collection

Growth performances

Average body weight, average daily gain (ADG), feed intake (FI), and feed conversion ratio (FCR) were recorded at 1 day old and 4, 6, 8, 10 and 12 weeks of age. All data were collected in the morning before feeding. Feed intake was recorded in order to calculate average daily gains (ADG) and feed conversion ratio (FCR). Chicken mortality was recorded as it occurred.

Carcass Analysis

Ten chickens of each breed were randomly divided into 5 females and 5 males to compare the differences in carcass quality. After bleeding, the chickens were humanely slaughtered and then scalded in a hot water bath (60°C for 45s) and the feathers were removed by automatic plucking machine. The carcass weight was calculated by removing the feathers, blood, head, feet, and organs. The carcass yield was expressed as a percentage of live weight. The wing, drumstick, thigh, breast (loin and tender loin), abdominal fat, liver, spleen, heart, gizzard and intestine were removed from the carcass and individually weighed.

Statistical Analysis

The completely randomized design (CRD) was used to analyses growth and carcass performance. The average of growth and carcass performance in each breed was analyzed by PROC MEANS. (SAS® University Edition, 2018). The regression analysis between body weight at 12 weeks of age and carcass composition was calculated. All data were analyzed by ANOVA with SAS software. Significant differences were based on $P<0.05$ by Duncan's new multiple range Test. The full statistical model was as follows:

$$Y_i = \mu + Breed_i + \varepsilon_i$$

Where

Y_{ijk} = observational values from growth and carcass performance at replication i (i = 1 to 5) and treatment j (j = 1 to 2)

μ = overall mean

$Breed_i$ = effect of chicken breeds in treatment j (j = 1 to 2)

ε_{ij} = experimental error

RESULTS

Growth Performance Comparison

The growth performance of Thai native chickens Chee KKU12 and Chee N is compared in Table 1. The average body weight at 6, 8, 10 and 12 weeks of age for Chee KKU12 chickens was higher than for Chee N chickens ($P<0.05$) with 540.522, 809.748, 980.882 and 1,279.484 g for Chee KKU12 chickens and 504.184, 749.144, 905.240 and 1,180.212 g for Chee N chickens, respectively. There was no significant difference ($P>0.05$) in body weight at the age of 1 day and 4 weeks in both groups. The difference in body weight between the two chicken breeds at 6 to 12 weeks of age was 36.34, 60.60, 75.64, and 99.27 g, respectively. When examined more closely, it was found that each Chee KKU12 chickens had higher body weight than Chee N chickens from 6 to 12 weeks of age as follows; 5.19, 8.66, 10.81, and 14.18 g/bird/day.

Table 1 Growth performance of Thai native chickens Chee KKU12 and Chee N

Traits	Native Chickens		SEM	P-value
	Chee KKU12	Chee N		
Average body weight (g/bird)				
D1	32.698	32.080	0.272	0.280
W4	290.472	276.214	4.449	0.112
W6	540.522[a]	504.184[b]	8.412	0.019
W8	809.748[a]	749.144[b]	12.650	0.006
W10	980.882[a]	905.240[b]	18.063	0.025
W12	1,279.484[a]	1,180.212[b]	25.739	0.045
Average daily gain (g/day)				
W0 - W4	9.206	8.719	1.552	0.127
W4 - W6	17.861[a]	16.284[b]	1.585	0.008
W6 - W8	19.230[a]	17.497[b]	1.128	0.028
W8 - W10	12.224	11.150	1.332	0.487
W10 - W12	21.329	19.641	1.315	0.415
W0 - W12	14.843[a]	13.668[b]	1.529	0.040
Feed intake (g/bird/day)				
W0 - W4	17.244[a]	16.136[b]	0.285	0.043
W4 - W6	31.918	31.300	0.476	0.548
W6 - W8	46.540	45.684	0.340	0.228
W8 - W10	47.642	42.022	1.895	0.146
W10 - W12	57.052	58.298	1.289	0.657
W0 - W12	40.078	38.690	0.481	0.159
Feed conversion ratio				
W0 - W4	1.326	1.328	0.032	0.977
W4 - W6	2.528	2.666	0.060	0.278
W6 - W8	3.434	3.660	0.088	0.215
W8 - W10	4.670	4.706	0.141	0.907
W10 - W12	3.204	3.426	0.241	0.672
W0 - W12	2.906	3.022	0.066	0.410

[a,b] value within the row with different superscripts are significantly different ($P<0.05$)

Average daily gains (ADG) of Chee KKU12 chickens and Chee N chickens at 4-6 weeks of age were 17.861 vs 16.284 g/day, at 6-8 weeks of age were 19.230 vs 17.497 g/day, and at 0-12 weeks of age were 14.843 vs 13.668 g/day, respectively, ($P<0.05$). While there was no significant difference ($P>0.05$) of the two chicken breeds of other age groups.

Feed intake (FI) of Chee KKU12 chickens at 0-4 weeks of age was higher than Chee N chickens (17.244 and 16.136 g/bird/day, respectively) ($P<0.05$) but there was no significant difference ($P>0.05$) at other weeks. However, the statistical difference of FI at 0-4 weeks of age can be explained because different body weight and ADG values were observed over a longer period of time. Feed conversion ratio (FCR) was not significantly different ($P>0.05$) in all ages of Chee KKU12 and Chee N chickens.

Carcass Quality Comparison

The carcass yield of Thai native chickens Chee KKU12 and Chee N is compared in Table 2. The live weight before slaughter of mixed gender native chickens ranged from 1,258 – 1,323 g. However, the live weight, the carcass weight and carcass percentages of both groups were not different ($P>0.05$). The relative component yields of native chickens were calculated based on carcass weight. The breast meat of Chee KKU12 and Chee N chickens analyzed by separate sexes, were not found to be statistically different ($P>0.05$). However when both sexes were combined it was found that breast meat of Chee KKU12 chickens (20.859%) was significantly higher than Chee N chickens (19.585%) in mixed gender ($P<0.05$). In the thigh meat it was found that Chee KKU12 males had thigh (%) lower than Chee N males, at 17.252% and 19.618%, respectively ($P<0.05$). For mixed gender chickens, the thigh (%) in Chee KKU12 was lower than Chee N with 17.007% and 18.627%, respectively ($P<0.05$). Moreover, abdominal fat (%) of Chee KKU12 was higher than Chee N ($P<0.05$).

Table 2 The carcass yield of Thai native chickens between Chee KKU12 and Chee N

Variable	Female				Male				Total			
	Chee KKU12	Chee N	SEM	P-value	Chee KKU12	Chee N	SEM	P-value	Chee KKU12	Chee N	SEM	P-value
Live weight (g)	1154	1152	26.585	0.973	1492	1364	44.317	0.159	1323	1258	40.344	0.435
Carcass weight (g)	764	753	16.263	0.757	988	894	30.017	0.122	876	824	26.726	0.340
Carcass (%)	66.274	65.386	0.626	0.511	66.252	65.540	0.483	0.494	66.263	65.463	0.385	0.312
Component yields[1]												
Wing (%)	14.530	16.328	0.541	0.097	14.086	13.660	0.291	0.498	14.308	14.994	0.348	0.338
Breast (%)	20.712	19.622	0.312	0.072	20.996	19.548	0.264	0.058	20.859a	19.585b	0.288	0.042
Drumstick (%)	15.732	16.594	0.486	0.407	17.540	16.980	0.244	0.276	16.636	16.787	0.293	0.804
Thigh (%)	16.762	17.636	0.369	0.259	17.252[b]	19.618[a]	0.516	0.010	17.007[b]	18.627[a]	0.340	0.013
Gizzard (%)	1.634	0.534	0.524	0.322	3.278	3.258	1.058	0.993	2.456	1.896	0.627	0.667
Heart (%)	0.726	0.742	0.024	0.761	0.858	0.772	0.035	0.233	0.792	0.757	0.023	0.452
Intestine (%)	59.022	60.830	2.550	0.745	52.658	64.230	6.103	0.374	55.840	62.530	3.223	0.312
Liver (%)	2.750	3.486	0.222	0.097	3.084	3.196	0.192	0.789	2.917	3.341	0.143	0.142
Spleen (%)	1.176	0.874	0.143	0.320	0.706	1.250	0.148	0.059	0.941	1.062	0.100	0.561
Abdominal fat (%)	0.730[a]	0.184[b]	0.146	0.004	0.588a	0.250[b]	0.090	0.005	0.659[a]	0.217[b]	0.084	0.005

Note: [a,b] value within the row with different superscripts are significantly different (P<0.05)
[1] Component yields were calculated as a percentage of the carcass weight.

The regression analysis between body weight at 12 weeks and carcass compositions

Table 3 shows the regression analysis between body weight at 12 weeks of age and carcass composition. The results indicated that in Chee KKU12 chickens, if the body weight increased by 1 g, the weight of the wing, breast, and drumstick portions increased to 0.074, 0.089, and 0.134 g, respectively. These values were significantly higher than in Chee N chickens ($P<0.05$), while Chee N chickens had more thigh meat than in Chee KKU12 chickens ($P<0.05$). Moreover, the body weight at 12 weeks of age increased by 1 g, the weight of the gizzard and heart increase 0.018 and 0.008 g, respectively.

Table 3 The regression analysis between body weight at 12 weeks and carcass compositions

Carcass compositions	Chee KKU12 slope (P-value)	Chee N slope (P-value)
Wing (g)	0.074 (0.016)	0.038 (0.131)
Breast (g)	0.089 (0.028)	0.079 (0.041)
Drumstick (g)	0.134 (0.001)	0.103 (0.004)
Thigh (g)	0.113 (0.001)	0.189 (0.001)
Gizzard (g)	0.018 (0.032)	0.001 (0.886)
Heart (g)	0.008 (0.001)	0.005 (0.027)
Intestine (g)	0.024 (0.136)	0.010 (0.551)
Liver (g)	0.021 (0.070)	0.009 (0.264)
Spleen (g)	0.002 (0.720)	0.015 (0.108)
Abdominal fat (g)	0.007 (0.231)	0.002 (0.283)

DISCUSSION

At the present study, we compared growth and carcass performance of native chickens (Chee) with a population selected for economic traits (Chee KKU12) and natural selection (Chee N). The results showed that the growth performance of Chee KKU12 chickens was better than Chee N chickens, especially in body weight and ADG, and indicated that improving chicken genetics could improve growth performance better than not improving chicken genetics. The result was according to the breeding objective of Chee KKU12 chickens that selected for high growth performance and wide breasts. The goal of genetic selection in modern poultry has been to increase the growth rate and final weight (Bramfeld et al., 2003). The ADG values of week 0-12 of Chee KKU12 and Chee N chickens were in the range reported by Laopaiboon et al. (2010) who found that the ADG of crossbred native Chee chicken was between 13.5 and 18.7 g/day, depending on sex and dam line. This is consistent with Promket et al., (2013) who found that the ADG and FCR for crossbred native chicken (Chee) was 19.43 g/day and 2.44, respectively. As a result, it seems to show that the native chicken may be improved through selection and crossbreeding. In general, the market weight of live chickens is 1,200 g. Therefore, considering the ADG during 0-12 weeks of age, it was found that raising Chee KKU12 chickens will take only 80.8 days to be ready

for wholesale markets, but on the contrary, we have to raise Chee N chickens 87.8 days to be able to deliver to the market. Additionally, the slower growth of Chee N chickens will be reflected in a higher cost of raising them.

The result of this study showed the difference of breast meat between Chee KKU12 and Chee N is equal to 1.274% as a result of the genetic improvement of the chickens. Chee KKU12 emphasized the growth and quality of meat, especially the breast meat, as it is rich in healthy protein, and suitable for health-loving consumers. In addition, abdominal fat (%) of Chee KKU12 was higher than Chee N ($P<0.05$), the Chee KKU12 chickens having been developed to fast growth, so their genes enable more efficient conversion of meat and fat in the abdomen. Nguyen and Bunchasak, (2005) found that Betong chickens had abdominal fat pads from 0.39% to 0.57% when energy was increased from 3,000 to 3,200 ME kcal/kilogram. Statistical differences were not found for other meat parts in both native chickens ($P>0.05$).

The weight of the native chicken that the consumer prefers is around 1,100-1,400 g. This is supported by many researchers such as Jaturasitha et al. (2002) who reported the market size of Thai native chicken at 12 weeks was 1,200 g. The dressing percentage of Thai native chickens was between 65.463 - 66.263%, which is slightly higher than found by Jaturasitha et al. (2002) who reported dressing percentage of Thai native was 64.54% and that this was not different from broiler chicken. Moreover, the common Thai native chickens showed dressing percentage was 78.6% (Chaiyawan et al., 2004). The thigh percentage in this study was different between 2 groups, Funaro et al. (2014) explained that carcass composition mainly reflected the genetic difference in breeds.

The result of regression analysis between body weight at 12 weeks of age and carcass composition showed that if body weight of Chee KKU12 increased 1 g the weight of wing, breast and drumstick portions increased also. These meats are highly priced when sold in disassembly, which will be useful for future chicken development plans. According with Pinto et al. (2006), showed that the body weight and carcass yields that can show the usefulness of chickens for commercial purposes. The correlation coefficient among breast circumference and carcass weight was positively and highly (0.80) (Yakubu et al., 2009). This is because growth in animals can be evaluated from the component parts of the animals (Egena et al., 2014).

CONCLUSION

The research compares growth and carcass performance between Chee KKU12 and Chee N chickens. At 12 weeks of age, the result showed that Chee KKU12 had higher body weight more than Chee N. Moreover, the averages daily weight gain at 4-6, 6-8, and 0-12 weeks of age on Chee KKU12 chicken was higher than Chee N chickens. In addition, the carcass quality showed that breast (20.859%) and abdominal fat (0.659%) of Chee KKU12 chicken was higher than Chee N chicken (19.585% and 0.217%, respectively). The thigh in Chee KKU12 chicken was lower than Chee N chicken with 17.007% and 18.627%, respectively. Economic selection can improve the performance of native chickens. In part of regression analysis, selection of Chee KKU12 chickens for 1 g body weight will increase wing (0.074 g), breast (0.089 g), and drumstick

(0.134 g). On the other hand, when selected for high growth performance in Chee N chicken had better thigh (0.189 g). Although native chickens are limited in terms of growth and carcass performance, if there is a clear and ongoing genetic improvement goal, improved growth performance and carcass quality can be achieved. This can be seen from the research reported here for Chee KKU12 chicken. The main impact is that farmers can raise chickens in a shorter period of time and have better meat quality than with non-selection chickens.

ACKNOWLEDGEMENTS

The research team would like to thank Network Center for Animal Breeding and OMICS Research, Khon Kaen University for support research funds. Thank you to the branch of Animal science, Faculty of Technology, Mahasarakham University for support research station.

AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows:

Doungnapa Promket: study conception and design, data collection, analysis and interpretation of results, draft manuscript preparation, reviewed the results and approved the final version of the manuscript.

Khanittha Ruangwittayanusorn: study conception and design, data collection, analysis and interpretation of results, reviewed the results and approved the final version of the manuscript.

CONFLICT ON INTEREST

There is no conflict of interest.

REFERENCES

Bramfeld, J. M., Fahey, A.J., Langley-Evans, S.C., Buttery, P. J. 2003. Nutritional and hormonal control of muscle growth and fat deposition. J. Arch. Tierz. 46, Special Issue, 143-156.

Bungsrisawat, P., Sornthep, T., Wiriya, L., Sasitorn, N., Panwadee, S. 2018. Genetic parameters of some carcass and meat quality traits in Betong chicken (KU line). Agric. Nat. Resour. 52, 274 – 279.

Chaiyawan, W., Songsang, A., Wattanasit, S., Adulyathum, P. and Wattanachant, S. 2004. Carcass qualities, chemical composition, physical properties and textural characteristics of meat from naked-neck chicken and common Thai indigenous chicken. Final report of the Thailand research Fund.

Egena, S. S. A., Ijaiya, A. T., Kolawole, R. 2014. An assessment of the relationship between body weight and body measurements of indigenous Nigeria chickens (Gallus gallus domesticus) using path coefficient analysis. Livest. Res. Rural. Dev. 26(3): 1-8.

Fanatico, A. C., Pillai, P. B., Hester, P. Y., Falcone, C., Mench, J. A., Owens, C. M., Emmert, J. L. 2008. Performance, livability, and carcass yield of slow- and fast-growing chicken genotypes fed low-nutrient or standard diets and raised indoors or with outdoor access. J. Poult. Sci. 87, 1012–1021.

Funaro, A., Cardenia, V., Petracci, M., Rimini, S., Rodriguez-Estrada, M. T., Cavani, C. 2014. Comparison of meat quality characteristics and oxidative stability between conventional and free-range chickens. J. Poult. Sci. 93, 1511–1522.

Haunshi, S., Niranjan, M., Shanmugam, M., Padhi, M. K., Reddy, M. R., Sunitha, R., Rajkumar, U., Panda, A. K. 2011. Characterization of two Indian native chicken breeds or production, egg and semen quality, and welfare traits. J. Poult. Sci. 90, 314–320.

Jaturasitha, S., Chaiwang, N., Kreuzer, M. 2016. Thai native chicken meat: an option to meet the demands for specific meat quality by certain groups of consumers; a review. J. Anim. Pro. Sci. 57, 1582 - 1587.

Jaturasitha, S., Leangwunta, V., Leotaragul, A. 2002. A comparative study of Thai native chicken and broiler on productive performance, carcass and meat quality. In: Proceedings of Deutscher Tropentag . International Research on Food Security, Natural Resource Management and Rural Development: Challenges to Organic Farming and Sustainable Land Use in the Tropics and Subtropics. Witzenhausen, Germany, p. 146.

Jaturasitha, S., Autchara, K., Michael, W. 2008a. Carcass and meat characteristics of male chickens between Thai indigenous compared with improved layer breeds and their crossbred. Arch. Tierz. 51: 283-294.

Jaturasitha, S., Srikanchai, T., Kreuzer, M., Wicke, M. 2008b. Differences in carcass and meat characteristics between chicken indigenous to northern Thailand (black-boned and Thai native) and imported extensive breeds (Bresse and Rhode Island Red). J. Poult. Sci. 87, 160 -169.

Kammongkun, J., Prapasawat, C., Leotaragul, A. 2015. Establishment foundation stock of Chee-Thapra breed of Thai native chickens. J. Khon Kaen Agri. 43 (Suppl), 2.

Kingori, A.M., Wachira, A.M., Tuitoek, J. K. 2010. Indigenous chicken production in Kenya: A review. Int. J. Poult. Sci. 9 (4), 309-316.

Laopaiboon, B., Duangjinda, M., Vongpralab, T., Sanchaisuriya, P., Nantachai, N., Boonkum, W. 2010. Testing of growth performances and meat tenderness in crossbred chicken from Thai indigenous sire and commercial dam. J. Khon Kaen Agri. 38, 373-384.

Nguyen, T.V., Bunchasak, C. 2005. Effects of dietary protein and energy on growth performance and carcass characteristics of Betong chicken at early growth stage. Songklanakarin J. Sci. Tech. 27 (6), 1171-1178.

NRC (National Research Council). 1994. Nutrition Requirements of Poultry. 9th ed. National Academy Press, Washington D.C.

Padhi, M. K. 2016. Importance of indigenous breeds of chicken for rural economy and their improvements for higher production performance. Scientifica. 2604685.

Pinto, L. F. B., Dacker, I. U., De melo, C. M. R., Ledur, M. C., Coutinho, L. L. 2006. Principal components analysis applied to performance and carcass traits in the chicken. J. Anim Res 55. 419-425.

Promket, D., Ruangwittayanusorn, K., Somchan, T., Champawadee, S. 2013. The study of growth performance on crossbred native chicken (Chee). The 4th International Conference on Sustainable Animal Agriculture for Developing countries (SAADC2013), 27-31 July 2013, Lanzhou University, China. 386-387.

Promket, D., Ruangwittayanusorn, K., Somchan, T. 2016. The study of carcass yields and meat quality in crossbred native chicken (Chee). Agric. Agric. Sci. Procedia. 11, 84 – 89.

Ruangwittayanusorn, K., Promket, D., Somchan, T., Chumnan, K., Thitasan, C., Koonsirisrap, T., Sriarch, N. 2012. The comparison of growth trait in 3 breed groups of Thai Native crossbred chicken. The 10th Naresuan agriculture national conference, 24-25, July 2012, Naresuan University, Thailand. 17-26.

SAS® University Edition. 2018, SAS Institute Inc., Cary, NC, USA.

Yakubu, A., Kingsley, O. I., Ya, I. A. 2009. Using factor scores in multiple linear regression model for predicting the carcass weight of broiler chickens using body measurements. Revista UDO Agricola. 9 (4): 963-967.

How to cite this article;

Doungnapa Promket and Khanitta Ruangwittayanusorn. The comparative of growth and carcass performance of Thai native chickens between economic selection (Chee KKU12) and natural selection (Chee N). Veterinary Integrative Sciences. 2021; 19(2): 247-257.