Can Tho University Journal of Science
website: sj.ctu.edu.vn

DOI: 10.22144/ctu.jen.2016.099

EVALUATION OF QUALITY TRAITS, CHEMICAL COMPOSITION AND EGG YOLK LIPID COMPONENTS OF NOI LAI CHICKEN

Nguyen Nhut Xuan Dung and Luu Huu Manh

Agriculture and applied Biology, Can Tho University, Vietnam

ARTICLE INFO

Received date: 27/07/2015
Accepted date: 08/08/2016

KEYWORDS

Cholesterol, HDL-C, egg quality, egg production cycle, crossbred Noi chicken, triglycerides

ABSTRACT

A total of 60 chicken egg litters of obtained from local scavenging hens (crossbred Noi) at the first drop (young hens) and later (old hens). Three eggs of each litter were used to determine egg weight, the chemical composition, egg quality and fat components as cholesterol, triglycerides and HDL- cholesterol. The results indicated that egg weight of the first litter was smaller (39.2 g) as compared to the later (41.9 g), but had proportionately higher in yolk index (0.275 vs 0.234), albumen index (0.074 vs 0.066), Haugh unit (83.2 vs 81.4) and shell ratio (12.7% vs 11.9%). There were no differences in whole egg or yolk or albumen composition between the eggs produced from young and old hens (P>0.05). Except, egg yolk protein content of old hen's eggs (15.4%) was higher than that of young hens (14.7%). Cholesterol content was lower in eggs of the young (8.0 mg/g yolk) as compared to that of old hens (8.94 mg/g yolk), in the reverse order for HDL-C (4.70 vs 4.15 mg/g yolk). Triglyceride content in egg of young hens (7.4 mg/g yolk) was higher than that of old ones (4.15 mg/g yolk). This study presented a preliminary database on quality traits, composition and lipid components of the Noi lai chicken keeping in the Mekong delta.

Cited as: Dung, N.N.X. and Manh, L.H., 2016. Evaluation of quality traits, chemical composition and egg yolk lipid components of Noi lai chicken. Can Tho University Journal of Science. Vol 3: 14-18.

1 INTRODUCTION

Chicken eggs are a high good quality food, local chicken production is characterized by small holders and plays a significant contribution to human livelihood and food security (Sonaiya *et al*., 2002). They are kept in scavenging backyard, being dual-purpose animals, supplying meat and eggs. In the Mekong Delta, there are some local chicken strains as Tau vang, ga Ta and Noi and crossed, unidentified and keeping by farmers, in which "Noi" chicken is the most common and occupies up 70% of total (Dung and Hai, 2007). The consumption of local eggs is very popular to Vietnamese consumers, who think they are good quality and prefer to commercial eggs. Chicken eggs produced from hens keeping under free range system are more color intensity, vitamin, fatty acid content in yolk (Egerer and Grashorn 2008; Krawczyk, 2009), free from antibiotics, artificial synthetic pigment and also cheaper than commercial eggs. According the Vietnamese, who believed eggs produced from young hens of the first litter are preferred than the old hens, because they are good quality, always used for home consumption, children, sickness persons and seemed like a special gift for relative and city people. However, egg production of local chick is poor and small size, is still remained a neglecting of quality and the belief is still undiscoverable.

This study was designed to determine and compare the chemical composition, quality and lipid components between the first and later eggs produced from young and old of crossbred Noi hens.

2 MATERIALS AND METHODS

2.1 Local and time

The study was carried out in Hon Dat district, Kien Giang province and the Animal Nutrition laboratory, Animal Sciences department, Faculty of Agriculture and Applied Biology, Can Tho University.

2.2 Data collection

An on-farm study was conducted on 30 different householders where keeping Noi lai scavenging hens. A pre-survey was done to identify households keeping Noi lai chicken at the first drop or late of laying stage. During visiting, information on chicken strains, ages, feeding, management and period of the laid eggs were recorded through personal interviews on each family.

Fig. 1: Hens of the "Noi lai" breed

Eggs produced from "Noi Lai" breed (Fig. 1) were taken because they were a major among local hens. At each farm, layers were classified into young and old ones, the first consisted of hens starting the first drop and the latter was hens giving the eggs after the first litter. A total of 60 litters including 30 young and 30 old hens were selected, labeled according to their group. Sub-sample was done by taking random sampling on three eggs per litter. There were a total of one hundred eighty eggs obtained from young and old hens of 60 different litters in 30 households. Collected egg samples were subsequently transported to the laboratory at the Animal Nutrition laboratory, Department of Animal Sciences, Can Tho University and kept at cool temperature (4°C).

2.3 Egg quality assessment

At farm, three eggs were randomly chosen from each litter, weighed, broken to determine internal and external quality traits. Albumen and yolk were carefully separated into Petri dishes; yolk and albumen height were measured using a spherometer. Shell thickness (exclusive of the shell membrane) was measured using a micrometer screw gauge at three locations, air cell, equator and sharp end. The yolk width, egg length and egg width were measured with the aid of vernier callipers. Egg shape index was determined according to Carter and John (1970), yolk index was taken as the ratio of yolk height to yolk width (Funk, 1948). Albumen ratio, yolk ratio and egg shell ratio were calculated. The Haugh Unit values were measured using a formula of Haugh (1937). Yolk color was determined by using Roche color fan.

2.4 Chemical analysis

Composition of eggs were analyzed for moisture, crude protein (CP: N*6.25), ether extract (EE), ash, calcium and phosphorus according to standard procedures of AOAC (1990). Cholesterol, triglycerides and HDL-cholesterol were done according to Pasin *et al*. (1998) and modified by Elkin *et al*. (1999) based on enzyme-substrate reactions using kits produced from Human Diagnostics Worldwide (Human GmbH-65205 Wiesbaden, Germany). The concentration of cholesterol, Triglycerides and HDL-cholesterol in the samples were determined by established specific enzymatic reaction in the present of the specific surfactants for cholesterol or triglycerides or HDL, then by comparing the O.D. of the samples to the standard curve.

2.5 Statistical analysis

Data of egg composition and quality were calculated for mean, standard deviation and variation coefficient. Two sample-t test were used to measure the variations between eggs of the young and old hens using Minitab 13 (Ryan *et al*., 2000)

3 RESULTS AND DISCUSSION

3.1 Management and feeding

It was difficult to know a ratio of male and female in a flock or even age of the laying hens since farmers had no records of the chicken mating, breeding and birth. Thus, Noi lai breed was identified based on characteristics as fast growth, wide body long, flat back, large head, eyes black with big red round neck long, dark gray feather, mixed with bright yellow, black feather tail, scaly leg tall with black grey or grey and egg shell color was light pink. Information of the young or old hens was received from farmers because they could know the young or old hens by collecting eggs of their litter.

The flocks were housed in simple cages making by bamboo and water palm leaves in backyard. Chicken were provided paddy rice in the morning or feed

leftover from kitchens, then farmers allowed them freely scavenge for their food during the day around homestead areas, under shade of fruit trees, so that they could find more feeds like insects, earth worms and green grasses. Most of households prevent only H5N1 for their flock by vaccinating program of the extension service in the village, no more vaccination done, no supplementation of antibiotics, minerals and vitamins. Eggs were laid in laying nest and stored under room temperature in trays. Many farmers said that most of the local eggs were incubated to hatch chicks or used for home consumption and a few were sold.

3.2 Egg quality of Noi lai chicken

Quality of eggs is shown in Table 1. It demonstrates that egg weight of the young hens was smaller (39.2 ± 5.53 g) than that of old hens (41.9 ± 3.40 g; P=0.03). There was a larger variation of egg size within young hens (CV = 14.1%). There was no difference in egg shape index between the young and old hens, while the yolk and albumen index, shell thickness, Haugh unit and shell ratio of the young hen's eggs were higher as compared to those of old hens. This could explain that the egg shell decreases as the birds older, but the egg size enhances with increasing hen age. When the egg shell weight increases, hens had inability to produce an increased amount of the activity of 25-hydroxycholecalciferol-1-hydroxylase, an enzyme involved in calcium homeostasis (Elaroussi *et al*., 1994), while albumen index and yolk index decline with hen age (Roberts and Blaney, 2000; Scott and Silversides, 2000).

Albumen ratio was similar between two egg types (P=0.24), albumen was affected by the strain of bird and genetic selection (Scott and Silversides, 2000) rather than the hen age. Thinning of the albumen is a parameter to evaluate egg quality loss, a large proportion of thick white and high Haugh unit is regarded as being of high quality eggs.

Yolk ratio of the young hen's eggs (34.5%) was similar to that of old hens (33.7%), both produced a bigger yolk ratio as compared to eggs of commercial laying hens (24%, Lan, 2011).

The yolk color of eggs from two groups was good, ranged from (8.29 to 8.29), this parameter is used to determine egg quality, and it is dependent on the diet and easily manipulated (Hunton, 1995). The local scavenger hens as Noi lai were allowed freely to find feedstuffs like green grasses containing high amount of natural pigment, which depositing in yolk and coloring it.

3.3 Composition of Noi lai chicken eggs

Mean values and variations of whole egg, yolk and albumen composition are presented in Table 2.

3.3.1 Whole eggs

The young hen's eggs had somewhat lower percentage of moisture (63.0%) compared to those of old hens (66.0%, P=0.07). There was not different (P=0.31) in protein content between young and old hen's eggs (10.3% and 10.6%, respectively). Similarity, the contents of fat, ash, Ca and P were not different between two egg types (P>0.05).

3.3.2 Egg yolk

The egg yolk weight of the young hens was smaller than that of old hens (P=0.03). Moisture content was not different between two egg types (52.7 and 53.2%, respectively), but protein content was found higher in eggs of the old hens (15.4% *vs* 14.7%). The contents of fat, ash and Ca were similar between two egg types (P>0.05), however, P content in eggs of the young hen was higher than that of old ones.

Table 1: Mean values and variations of egg quality

	Eggs of young hens, n=30		Eggs of old hens, n=30		
	Mean ± SD	**CV,%**	**Mean ± SD**	**CV,%**	**P**
Egg weight, g	39.2 ± 5.53	14.1	42 ± 8.19	8.11	0.03
Shape index	75.4 ± 3.15	4.18	75.8 ± 1.98	2.62	0.54
Yolk index	0.28 ± 0.08	28.8	0.23 ± 0.08	33.4	0.06
Albumen index	0.074±0.01	17.9	0.07±0.01	22.2	0.04
Shell thickness, mm	0.32 ± 0.03	9.20	0.30 ± 0.02	7.61	0.01
Haugh Unit	83.2 ± 2.15	2.58	81.4 ± 1.94	2.38	<0.01
Yolk color	8.29 ± 1.15	13.9	8.2 ± 0.86	10.5	0.64
Yolk ratio, %	34.5 ± 5.48	15.9	33.7 ± 4.53	13.4	0.56
Albumen ratio, %	52.8 ± 5.44	10.3	54.3 ± 4.45	8.18	0.24
Shell ratio, %	12.7 ± 1.11	8.74	11.9 ± 0.69	5.81	<0.01

n= sample number (3 eggs/sample)

3.3.3 Egg albumen

The egg albumen weight of the young hen (20.7 g) was smaller than that of old hens (22.7 g; P=0.03). The contents of moisture, protein, ash and P were similar in both egg types (P>0.05), whereas for Ca content was higher in the young hen's eggs (P=0.05).

The egg compositions were good parameters to consumers; there was not much difference between two egg types. The differences in protein and P contents of the yolk and Ca in albumen might be due to the different selected feeds of scavenging hens. At the moment, there was no information on chemical composition of the eggs produced from local chicken in Vietnam, while it is very abundant in exotic commercial eggs.

Table 2: Mean values and variations of egg composition

Nutrient contents, %	Eggs of young hens		Eggs of old hens		
	Mean ± SD	CV,%	Mean ± SD	CV,%	P
Whole egg(*)					
Moisture	64.8 ± 2.58	13.2	65.9 ± 2.33	3.53	0.07
Protein	10.3 ± 1.23	11.9	10.6 ± 1.03	9.68	0.31
Fat	9.76 ± 1.67	17.1	9.64± 1.98	16.0	0.76
Ash	0.95 ± 0.14	14.4	0.97 ± 0.13	13.0	0.55
Ca	0.32 ± 0.13	38.9	0.28 ± 0.12	43.4	0.18
P	0.14 ± 0.02	19.6	0.18 ± 0.04	22.1	0.17
Yolk					
Weight, g	13.5 ± 2.52	18.7	14.2 ± 2.55	17.98	0.03
Moisture	52.7 ± 2.47	4.68	53.2 ± 2.08	3.91	0.44
Protein	14.7 ± 1.55	10.5	15.4 ± 1.07	6.97	0.04
Fat	28.3 ± 1.50	5.31	29.0 ± 3.12	10.8	0.65
Ash	1.79 ± 0.21	11.5	1.79 ± 0.23	13.03	0.98
Ca	0.48 ± 0.20	40.8	0.47 ± 0.17	34.8	0.81
P	0.53 ± 0.04	7.9	0.50 ± 0.06	11.04	0.05
Albumen					
Weight, g	20.7 ± 3.72	19.9	22.7 ± 2.49	10.9	0.02
Moisture	84.9 ± 14.4	16.9	88.5 ± 1.58	1.78	0.18
Protein	9.74 ± 1.97	20.2	9.90 ± 0.16	23.0	0.64
Ash	0.63 ± 0.20	30.7	0.68 ± 1.63	16.5	0.33
Ca	0.29 ± 0.12	42.4	0.22 ± 0.15	68.8	0.05
P	0.02 ± 0.02	75.5	0.02 ± 0.01	60.7	0.11

(*) Excluding egg shell

3.3.4 Yolk fat components of local chicken eggs

Table 3 presents the lipid components of the two egg yolk types. Cholesterol content was significantly (P=0.01) lower in the first eggs (8.0 mg/g yolk) than that of old hens (8.94 mg/g yolk). However, cholesterol content recorded in whole eggs was similar between two egg types (P=0.70), as a result of their smaller weight. Yolk cholesterol value of Noi lai chicken was found low in this study, when it was comparable with egg of white Leghorn (14.6 mg/g yolk, Jiang *et al*., 1991); this information was confirmed by Krawczyk (2009) that native chicken eggs often contain low cholesterol.

Triglycerides content was slightly higher in the young hen's eggs (50.5 mg/g yolk) as compared to that in the old hen's eggs (38.8 mg/g yolk) (P=0.14), but it was significantly different between eggs of the young and old hens (P=0.01) when calculated in whole egg (803 and 548 mg egg, respectively). Higher triglycerides content in the young hen's egg yolk indicates that this egg is tastier as farmer belief.

HDL-cholesterol content in young hen's eggs (4.7 mg/g yolk) was higher than that in old hen eggs (4.15 mg/g yolk) (P=0.01), but the trend was similar in whole eggs (P=0.53), although HDL-C (mg/egg) of the first eggs was somewhat higher than that of eggs of the old hens.

Table 3: Means and variations of yolk fat components

	Eggs of young hens	CV,%	Eggs of old hens	CV,%	P
Cholesterol, mg/g yolk	8.00	20.1	8.94	18.3	0.01
Cholesterol, mg/egg	127	24.5	126	20.1	0.70
Triglycerides, mg/g yolk	51	33.0	38.8	20.3	0.14
Triglyceride, mg/egg	8030	34.1	548	24.7	0.01
HDL-Cholesterol, mg/g yolk	4.70	19.4	4.15	27.9	0.01
HDL-C, mg/egg	68.2	19.4	57.9	28.5	0.53

4 CONCLUSION

Results obtained from this study showed that quality traits of eggs from Noi lai chicken were found to be different. The young hen's eggs were characterized by higher in yolk and albumen index, Haugh unit and shell thickness, but both had desirable yolk color. Two egg types contained the same value of protein, fat, ash, calcium and phosphorus. Lower level of cholesterol, but higher HDL-cholesterol was found in the young hen's eggs. Triglycerides content was also higher in the first drop eggs.

This study provided a preliminary database on egg quality traits, its composition and lipid components of the Noi lai chicken in the Mekong Delta.

REFERENCES

AOAC, 1990. Offcial Methods of Analysis. 15th ed. Association of Official Analytical Chemists. Arlington, VA.

Carter, T.C., Jones, R.M., 1970. The hen's egg shell shape parameters and their interrelations. Br. Poult. Sci. 11: 179-187.

Egerer, U., Grashorn, M.A., 2008. Integrated assessment of egg quality by biophoton measurement (Ganzheitliche Beurteilung der Lebensmittelqualität: Die Biophotonenmessung bei Hühnereiern). Tierärztliche Umschau 63 (3): 150-158.

Elaroussi, M.A., Forte, L.R., Eber, S.L., Biellier, H.V., 1994. Calcium homeostasis the laying hen. 1. Age and dietary calcium effects. Poult. Sci. 73: 2590-1595.

Elkin, R.G., Yan, Z., Zhong, Y., Donkin, S.S., Buhman, K.K., Story, J.A., Turek, J.J., Porter, E., Anderson, M., Homan, R., Newton, R.S., 1999. Select 3-hydroxy-3-methylglutaryl-coenzyme A reductase inhibitors vary in their ability to reduce egg yolk cholesterol levels in laying hens through alteration of hepatic cholesterol biosynthesis and plasma VLDL composition Journal of Nutrition 129 1010-1019.

Funk, E.M., 1948. The relation of the yolk index as determined after separating the yolk from the albumen. Poult. Sci., 27: 367.

Haugh, R.R., 1937 The Haugh unit for measuring egg quality. US egg. Poult. Mag., 43: 522-555.

Hunton, P., 1995. Egg production, processing and marketing. Pages 457–481 in Poultry Production. P.Hunton, ed. Elsevier, New York.

Jiang, Z., Fenton, M., Sim, J.S., 1991. Comparision of four different methods for egg cholesterol determination. Poult. Sci., 70:1015-1019.

Krawczyk, J., 2009. Quality of eggs from Polish native Greenleg Partridge chicken-hens maintained in organic vs. backyard production systems. Animal Science Papers and Reports 27(3): 227-235.

Dung, N.M., Hai, H.H., 2007. Investigation of Noi chicken in the Mekong Delta. Mimeograph.

Pasin, G., Smith, G.M., O'Mahony, M., 1998. Rapid determination of total cholesterol in egg yolk using commercial diagnostic cholesterol reagent. Fd. Chem. 61: 255-259.

Roberts, J.R., Blaney, C.N., 2000. Eggshell ultrastructure and shell quality - Relationship of ultrastructure to eggshell quality and strength. World's Poult. Sci. Rev. Conference Montreal Canada.

Ryan, B., Joiner, B.L., Ryan, Jr.T.A., 2000. Minitab Statistical Soffware. Release 13. Duxbury Press.

Scott, T.A., Silversides, F.G., 2000. The effect of storage and strain of hen on egg quality. Poult. Sci. 79:1725–1729.

Sonaiya, E.B., Dazogbo, J.S., Olukosi, O.A., 2002. Further Assessment of Scavenging Feed Resource Base. From<http://www.ilri.org/> (Retrieved on 28 January 2012).