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Effects of Housing Systems on Some Fatty Acid Contents of Hen's Eggs

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This research was carried out to investigate the effects of housing systems (deep litter, free range and cage systems) on fatty acids composition of eggs obtained from brown layer strain of ATAK (G_xS_x). In deep litter, free range and cage systems of the egg contain palmitic fatty acids, were 24.14, 24.30 and 34.2 %; stearic fatty acids were 5.21, 5.34 and 4.56 %; palmitoleic fatty acids were 4.17, 3.45 and 3.62 %; oleic fatty acids were 46.57, 47.28 and 46.06 %; linoleic fatty acids were 17.90, 16.86 and 20.01 % in three conditions, respectively. In conclusion, more detailed studies are necessary to show the differences and advantages of main applicable poultry housing systems.

Key Words: Housing systems, Egg fatty acids, Free range, Cage, Deep litter.

INTRODUCTION

In recent years, there has been a rapid improvement in poultry housing, as a result of implementation of scientific and technological developments. Chicken egg and meat have become foods that can be afforded by anyone. Egg consumption has been decreasing or the demand for egg with low cholesterol content has been increasing rapidly due to the claims that some antibiotics used in chicken keeping have toxicological and resistance danger[1], additives of some hormones used cause health problems for people[2] and that eggs cause coronary heart failure and atherosclerosis due to the cholesterol content[3]. At the same time, recent studies on fats have shown that *trans*-fatty acids have some serious harmful effects[4]. It was well established that the *trans*-fatty acids increase LDL while they reduce HDL levels in blood, increase coronary heart failure risk. However, some fatty acids are said to prevent heart attacks and reduce death ratios[5,6].

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In Western societies with high prosperity and education levels, the demand for products with low egg cholesterol and high polyunsaturated fatty acids and vitamins from choosy customers has increased. Poultry breeders in western countries have been developing alternative housing systems in order to meet the demand. Studies about the effects of housing systems on poultry products are limited in Turkey[7-9]. Especially comparison of the housing systems with free range system can bring some new insights on the subject.

The objective of this study was to determine the effects of tree different type of housing systems (deep litter, free range and cage) on fatty acid contents of eggs.

EXPERIMENTAL

Animal materials of the experiment consisted of 32 weeks old, brown ATAK (G_xS_x) layer strain. In the experiment, deep litter and free range systems were replicated for four times with 20 birds per replication and cage system was replicated for six times with 16 birds in per replicate. A total of 256 ATAK layer birds were used in this experiment.

Stocking density of deep litter system was 3.7 bird/m^2 and it was 1.0 bird/m^2 in free range system with outside area and every replication in cage system consisted of 4 divisions (48 × 42 × 45 cm), each having four birds. Layer house and free range area were located in the college farm of Gaziosmanpasa University. Watering and feeding equipments were obtained according to bird number and water and feed were supplied *ad libitum*. The daily photoperiod consisted of 16 h light and 8 h darkness. During the experimental period hens in free range system had access to free range throughout day (from 8.00 am to 17.00 pm).

Birds were fed with pullet grower diet containing 2850 kcal ME/kg and 15 % crude protein until 20 wk of age. Birds were fed with the standard layer diet (2700 kcal ME/kg and 18 % crude protein) during the experimental period.

Egg samples were collected from 32-week-age hens and randomly selected for the analyses of the fatty acid contents. Eggs were weighed (0.1 g) and broken and then the yolk was separated from the albumen. 12 Samples for each treatment were freezer dried and stored at -20 ºC systems before the fatty acid analyses were performed. The total fat of yolks was extracted according to Folch *et al.*[10] and methylated with 5 % boron trifluoride methanol complex in methanolic solution[11]. The lipid profile was determined at the Laboratory of the Marmara Research Center linked to the Scientific and Research Council of Turkey by using Perkin Elmer autosystem XL gas chromatograpy[12].

Statistical analysis carried out by using the Generalized Linear Model Procedure of SPSS (Version 11.0). Before the analyses, data distribution was tested for normality by Probit analysis and variance homogeneity by Bartlett test. The significant differences among the mean values of threatment determined by Duncan test[13].

RESULTS AND DISCUSSION

The results obtained from the study are presented in Table-1. Mean palmitic fatty acid contents of eggs were defined according to housing systems and presented as 24.14 % for deep litter, 24.30 % for free range and 24.12 % for cage. There was no any significant difference between housing systems regarding palmitic fatty acid contents of eggs ($p > 0.05$). Mean stearic fatty acids contents of eggs changed from 24.12 to 24.30 % in their order of deep liter (5.21 %), free range (5.34 %) and cage (4.53 %), respectively. However, the effect of housing systems on the stearic fatty acid contents of eggs was not statistically significant ($p > 0.05$).

TABLE-1
SOME FATTY ACIDS CONTENTS IN EGGS AT DIFFERENT SYSTEMS

Traits	Production systems			SEM*	P**
	Deep litter	Free range	Cage		
Saturated fatty acids (%)	**29.95**	**30.48**	**29.16**		
Palmitic	24.14	24.30	24.12	0.21	0.94
Stearic	5.21	5.34	4.56	0.15	0.06
Unsaturated fatty acids (%)	**70.05**	**69.52**	**70.84**		
Palmitoleic	4.17†	3.45‡	3.62‡	0.13	<0.02
Oleic	46.57	47.28	46.06	0.47	0.58
Linoleic	17.90	16.86	20.01	0.59	0.07

*Standard error of the means.
**Difference among features that are shown in the same line by different letters is statistically important.
†‡ = Means within rows with different superscripts differ at $p < 0.05$ or 0.01.

Palmitoleic fatty acids contents of eggs of deep litter, free range and cage housing systems was 4.17, 3.45 and 3.62 %, respectively. There was significant difference between housing systems regarding palmitoleic fatty acid contents of eggs ($p < 0.05$). Oleic fatty acid contents of eggs was the highest in free range housing systems (47.28 %), intermediate in deep litter housing systems (46.57 %) and the lowest in cage housing systems (46.06 %). The effect of housing systems on oleic fatty acid contents of eggs was found insignificant ($p > 0.05$). Linoleic fatty acid contents of eggs obtained from

different housing system varied from 16.86 to 20.01 and there were no significant differences between different housing systems ($p > 0.05$).

Numerous researchers stated that eggs from free range system contain higher unsaturated fatty acids than those eggs from other poultry housing systems[14-16]. However, no effect of housing system on fatty acids has been detected in the present study except for palmitoleic acid which was significantly higher in eggs from deep litter system.

Conclusion

As a result of the present study, it was determined that there were no great differences among deep litter, free-range and cage systems. On the other hand it is a well known realty that some consumers prefer free range poultry products because of their healthy recognition. Therefore more detailed studies have to be employed on free range poultry products to inform the costumers. With the support of this kind of studies controlled free range production may spread throughout the rural area.

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