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Research Article

Effect of Housing Enrichment on Performance, Behavior and Meat Quality of Egyptian Geese

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Abstract

Background: Avian species play a vital role in livelihood of human beings throughout the world, especially in developing countries. Backyard poultry provides livelihood to large and small farmers, while the poultry industry has a lead role in raising the economic resources of country, especially the agricultural sector. This study was conducted to evaluate the effect of housing system enrichment on the performance, behavior and meat quality of Egyptian geese. **Materials and Methods:** Sixty geese were divided into 2 groups, 30 birds per group according to housing system, geese of the first group reared on a pen supported by a swimming pool, these birds have the chance for swimming, while birds of second group housed in pen without a swimming pool. Body weight of 10 geese from each group was measured every 2 weeks, behavior was observed throughout the study period and at the end of the study, 5 birds from each group were slaughtered for meat analysis. **Results:** The results showed that a significant difference in body weight and fat percent of meat as affected by housing system for second group birds ($p < 0.05$), also housing system enrichment affected significantly on some behaviors as drinking, body care, comfort and rest and sleep ($p < 0.05$) and ($p < 0.001$). **Conclusion:** It was concluded that supplying geese house with a swimming pool leads to increase the body care and comfort behavior and give geese low time to rest and sleep on the other hand, it leads to decrease the body weight of geese, also lower the fat percent of the meat.

Key words: Geese, behavior, meat, performance, housing, enrichment, welfare, swimming

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

It is generally accepted that geese, which of the family *Anatidae* and the genus *Anser* was one of the first animals to be domesticated, geese domestication in Egypt probably took place about 3000 years ago¹. Housing system of birds is one of many non-genetic factors that can affect meat quality and carcass traits²⁻⁵.

Although, a few data on the environmental aspects of geese breeding have been reported, geese can be housed on the floor or on wire floors or can be stocked in a free range. Poultry raised under stocking conditions are usually smaller than those under confinement housing conditions⁶. Goose digestive tract can ingest and digest large quantities of relatively cheap and easily accessible, high fiber feed stuffs, juveniles grow rapidly and are easy to manage⁷.

Geese meat characterized by low fat, high levels of unsaturated fatty acids and high protein levels compared to other birds⁸, so from economic point this meat is high in nutritive value and cheap. In Egypt there is a huge deficiency in water fowl meat consumption, it was about 0.57 kg of geese per person per year⁹. To provide the optimum housing condition to get maximum productivity and to save welfare for geese, this study was conducted to clear the effect of housing system enrichment with a swimming pool on growth rate (body weight gain), meat quality (fat, protein and moisture) percent, which has an important economic value and behavioral patterns of Egyptian geese. This study focuses on swimming because geese in nature are water fowl, naturally they prefer water and always need water to swim.

MATERIALS AND METHODS

This study was conducted in the Department of Animal Hygiene, Behavior and Management, Faculty of Veterinary Medicine, Benha University, Egypt between first of May to last of August, 2011.

Birds: A total number of 60 geese 2 months age with average body weight 1800 ± 200 g were purchased from the local market and transported in clean, well-ventilated boxes to the poultry house. The geese were identified by numbered rubber bands, which were hanged in the bird's shank. The birds were divided randomly into 2 groups according to housing system each one contains 30 birds. The bird's house of the first group enriched with a swimming pool, while the second group house not supplied with a swimming pool.

Preparation of the house: As a routine work before arrival of birds, the house was cleaned and disinfected using 10% formalin by fumigation according to the recommendation of Sainsbury¹⁰.

Housing system: The house contains two separated pens with the same dimensions ($6 \times 4 \times 3.50$ m) with concrete floor, covered by a clean thick layer of 14 cm wood shaving, one pen for each group, the pen of the first group enriched with a swimming water pool ($3 \times 1.50 \times 0.60$ m) provided with a water tap. The swimming pool was drained through the main drainage system and water was changed daily, because of this pool geese of first group have the chance to spend a part of the day swimming, while the pen of the second group geese not supplied by a swimming pool, so these geese do not have the chance to swim. The wetted wood shaving, which covered the house floor was removed periodically and the water was drained daily after the birds finished swimming. Food was supplied 3 times *ad libitum* daily in plastic feeders and water was supplied at all times in plastic drinkers. The ration composed of yellow corn and alfalfa.

Geese performance

Body weight and body weight gain: Ten birds from each group were chosen randomly before start of study as indicator for growth rate of the group, each bird from these 10 birds was weighed every 2 weeks and the live body weight changes were taken as a measure for growth. Body weight gain of birds (expressed in grams) was calculated as the difference between two successive weights.

Behavioral observation: Observation of geese behaviors was carried out according to Martin and Bateson¹¹. Birds were observed 3 times daily, at early morning (8:00-9:00 am), at noon (12 am-1.00 pm) and at afternoon (4.00-5.00 pm) for 3 days per week. The following behavioral patterns were discriminated.

Drinking: The bird inserted the beak in water and raised his head performing the normal drinking posture characteristic of geese.

Body care behavior

Cleaning behavior: Cleaning behavior included the following activities:

- **Auto preening:** Preening is series of movements, by which feathers were arranged and it was done with the bill¹²

- **Oiling:** Oiling is the transfer of oil to the feathers from the uropygial gland at the base of the tail¹³
- **Social preening:** One bird preens and cleans another bird
- **Mouth washing:** The bird dips his beak in water trough, shakes mouth in water
- **Rubbing:** Shoulder rubbing by the back or side of the head against the shoulder¹³
- **Foot cleaning:** Bird stands on one leg raises the foot to be cleaned and with the beak removes dirt from the foot
- **Scratching:** Scratching of the head by the leg¹⁴

Comfort behavior: Comfort behavior included the following:

- **Shaking behavior:** The head is moved from side to side¹³
- **Stretching behavior:** Extension the leg and wing on the same side of the body¹⁴

Rest and sleep

Resting: During rest the head was moving regularly and the eyes were open, the tail was slightly down or the head was motionless, the eye was closed or slowly open and close. Resting can be performed in a sitting or standing position¹⁵.

Sleeping: At sleeping the bird's head was tucked into the feathers above the wing base or even behind the wing. Feathers were slightly fluffed and sometimes the wings were drooping. While, sleeping stand alight crouching posture was shown. The tail was down, it could be performed in sitting as well as a standing position^{15,16}.

Meat quality examination: At the end of the study 5 birds from each group were randomly choose and after taken permission from Ethics Committee of Faculty of Veterinary Medicine, these birds were slaughtered, cleaned by removing feather and skin, a piece of meat from breast muscles from each bird was taken by knife for (protein, moisture and fat) analysis by using some chemical methods and materials according to AOAC¹⁷.

Statistical analysis: The SAS software (version 6.12ED)¹⁸ was used to explain the effect of housing system on body weight in gram, behavior percent and meat component percent by (ANOVA), data are presented as Means \pm Standard Errors and difference was declared as significant when $p < 0.05$.

RESULTS AND DISCUSSION

Geese body weight: Body weight was higher in geese kept in house without a swimming pool, especially at the age between 5-6 months than those, which have the ability to swim in the pool ($p < 0.05$) (Table 1). Results of this study confirmed that the body weight of geese reared at house without enrichment was higher than body weight of geese, which have the chance to swim in water pool, especially at the age between 5-6 months of geese age, these results might be attributed to geese, which swim in water loss much energy and weight during swimming. The obtained results in this study, agreed with El-Hanoun *et al.*¹⁹ who reported that body weight of geese was significantly ($p \leq 0.05$) greater in the Intensive System (IS), in which geese kept in confinement in a house without access to swimming water than the Semi Intensive System (SIS), in which geese allowed to water ducts for swimming and Pasture System (PS) and also with Kolluri *et al.*²⁰ who reported that ducks in intensive system had much higher weight than ducks in free range system. The results do not agree with El-Edel *et al.*²¹ who found that the housing system has effect on the body weights of birds as the ducks in the outdoor housing system supplied by tunnel of running water showing higher initial body weights, weights during the 2nd, 4th and 6th week of the housing period and final body weights than those in the indoor housing system.

Geese behavioral patterns

Drinking behavior: Results confirmed that higher drinking frequency for geese reared in house without water pool than geese, which had the chance to swim in the swimming pool (Table 2). Lower frequency of drinking behavior was observed in geese reared in house supported by a swimming pool, than those kept in the house without pool, the differences may be due to geese during swimming drink much amount of water from the water pool.

Body care behavior and comfort behavior: Results revealed that all types of cleaning and body care behaviors affected significantly by the rearing system ($p < 0.001$) as geese lived in house supported by a swimming pool showed higher grooming and cleaning rates than others (Table 2). Shaking and stretching affected by housing system ($p < 0.001$) as birds at the house contains a swimming pool showed higher levels of comfort than other birds (Table 2). Over the course of the study the body care and comfort behaviors showed the highest levels on geese, which allowed to swim in water than other birds, it may be due to geese swim in water spending apart of the day in the water pool, consuming much time in

Table 1: Body weight of geese in gram as affected by housing system enrichment

Housing system	Geese body weight (g) at the age between 5-6 months		
	5 months	5 months and 2 weeks	6 months
House enriched with swimming pool	2516.50±84.9 ^b	2700.00±84.2 ^b	2780±90 ^b
House without a swimming pool	2934.40±84.9 ^a	3032.50±84.2 ^a	3100±90 ^a

Means±SE in the same column with different superscripts letter are significantly different at (p<0.05) and highly significant when (p<0.01) and (p<0.001)

Table 2: Percent of some behaviors of geese as affected by housing system enrichment

Housing system	Percent of behavior			
	Drinking	Body care behavior	Comfort behavior	Rest and sleep
House enriched with swimming pool	2.75±0.19 ^b	6.33±0.25 ^a	2.61±0.08 ^a	4.25±0.26 ^b
House without a swimming pool	3.50±0.19 ^a	2.66±0.25 ^b	1.00±0.08 ^b	5.25±0.26 ^a

Means±SE in the same column with different superscripts letter are significantly different at (p<0.05) and highly significant when (p<0.01) and (p<0.001)

Table 3: Meat component percent as affected by housing system enrichment

Housing system	Percent of meat component		
	Protein	Moisture	Fat
House enriched with swimming pool	21.52±0.24 ^a	72.96±0.55 ^a	2.82±0.06 ^b
House without a swimming pool	21.18±0.24 ^a	71.72±0.55 ^a	4.60±0.06 ^a

Means±SE in the same column with different superscripts letter are significantly different at (p<0.05) and highly significant when (p<0.01) and (p<0.001)

preening, rubbing, stretching and shaking to remove the water from the body. The results of this study agree with the results of Abd-El-Gawad *et al.*²² who mentioned that goslings kept in open system were performed more preening, flapping their wings, more splashed their bodies with water more playful, also the results agree with Black and Hughes²³ and Tanaka and Hurnik²⁴ who reported that comfort behaviors in caged birds were reduced to 14-19% and the range of activities was limited than those in pens. The result not agrees with El-Edel *et al.*²¹ who found that the housing systems appeared to affect the behaviors of ducks with the birds in the indoor housing system stretching their wings and legs and performing more body care behaviors than those in the outdoor housing system.

Rest and sleep: Results showed that the house without swimming pool gives the chance for birds to rest and sleep more than house, which contains a swimming pool (p<0.05) (Table 2). This study revealed that presence of a swimming pool in geese house leads to decrease frequency of rest and sleep of birds, it might be because of geese, which allowed to the water pool were more alert and spent more time in grooming and playing after swimming. The obtained results in agreement with Abd-El-Gawad *et al.*²² who mentioned that goslings kept in open system were exploring their habitat and more alert.

Geese meat quality: Results of this study exhibited that the fat percent of geese meat affected by housing system enrichment (p<0.05), while there were no significant

differences in protein and moisture percent of meat due to housing enrichment (Table 3). A little significant difference in fat percent of geese meat was observed due to housing system, while there is no significant difference in moisture and protein content of meat due to housing geese, which lived in enriched house had lower fat percent than birds and which lived in house without a swimming pool. Other factors as sex and age may be the main cause of difference in meat quality. The results of the present study in accordance with the results of Liu *et al.*²⁵ who found that the nutrient composition (water, protein) of the muscle was not affected (p>0.05) by rearing system but do not agree with Fanatico *et al.*²⁶ who said that rearing system had no effect in the intra muscular fat.

CONCLUSION

Supplying geese house with a swimming pool leads to increase the body care and comfort behavior and give geese low time to rest and sleep, on the other hand it leads to decrease the body weight of geese, also lower the fat percent of the meat.

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SIGNIFICANCE STATEMENT

- Housing system affects on body weight of geese
- Housing system has an effect on meat quality of geese especially fat content
- Housing system of geese has a great effect on welfare related behaviors

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