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Effects of Age, Sex, Feather Colour, Body Measurements, and Body Weight on Down and Feather Yield in Native Turkish Geese*

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Abstract: The aim of this study was to calculate the feather and down production by native Turkish geese and to investigate the effects on these traits. In total 145 native Turkish geese were used in the experiment. The birds were divided into 4 groups according to their feather colour at 10 and 12 weeks of ages. They were individually weighed and measured with the help of wing tags. Geese at 10 weeks had heavier feathers than those at 12 weeks, while geese at 12 weeks produced more down ($P < 0.01$). As detected in down weight, the older group has a greater amount of total feathers than the younger group ($P < 0.001$). Male geese produced significantly heavier feathers and down than females ($P < 0.05$). While black geese produced the heaviest feathers, yellow geese produced the heaviest down ($P < 0.05$). White geese generated the lightest weights of the products. The strongest correlation was found between total feather yield and chest girth (0.75). Reasonable correlations were detected between liveweight and other traits (0.36-0.62). This is not a widely studied subject in Turkey; therefore, the data obtained can be used for the identification of native Turkish geese.

Key Words: Geese, body measurements, feather

Yerli Kazlarda Yumuşak ve Sert Tüy Verimi Üzerine Yaş, Cinsiyet, Tüy Rengi, Vücut Ölçüleri ve Vücut Ağırlığının Etkileri

Özet: Çalışmada yerli kazların yumuşak ve sert tüy verimlerinin tespiti ve bu verimler üzerine etki eden faktörlerinin belirlenmesi amaçlanmıştır. Bu amaç dâhilinde 145 adet yerli kaz kullanılmıştır. On ve oniki haftalık kazlar kendi içlerinde renklerine göre 4 gruba ayrılmıştır. Kazlara takılan kanat numaraları sayesinde bireysel ölçüm ve tartım düzenli bir şekilde yapılmıştır ve 10 haftalık kazlar 12 haftalıklardan daha ağır sert tüy verirken, 12 haftalık kazlar 10 haftalıklardan daha fazla yumuşak tüy vermiştir ($P < 0,01$). Yumuşak tüy veriminde belirlendiği gibi yaşlı kazlar genç kazlara göre daha fazla toplam tüy verimine ulaşmıştır ($P < 0,001$). Bunun yanında erkek kazların da dişilere göre daha fazla sert ve yumuşak tüy ürettikleri belirlenmiştir ($P < 0,05$). Önemli farklılıklar tüy renginde de ortaya çıkmış ($P < 0,05$) ve siyah kazlar sert tüy veriminde önde iken sarı kazlar en fazla yumuşak tüyü üretmiş, beyaz kazlar ise incelenen her ürün için en düşük düzeyde kalmışlardır. En kuvvetli korelasyonlar toplam tüy verimi ile göğüs çevresi (0,75) arasında bulunurken, canlı ağırlık ile diğer özellikler arasında orta düzeyde korelasyonlar tespit edilmiştir (0,36-0,62). Bu çalışmada incelenen konu Türkiye'de yaygın bir çalışma alanı bulamadığından dolayı, elde edilen veriler yerli kazların tanımlanmasında kullanılabilecek niteliğe sahiptir.

Anahtar Sözcükler: Kaz, vücut ölçüleri, tüy

Introduction

Geese produce down and feathers, in addition to being important as food. Down and feather yields are considered economic traits in the goose industry; therefore domestic geese are commercially valuable for these traits. Goose feathers and down provide high-quality insulation in garments and fabrics. For this reason, there is a constant demand for them. Although

they are produced together from the goose, feathers are heavier and harder than down. Down is well known to be much more lightweight, and so it is considered the most valuable product obtained from the breast area of the goose, followed by the fine feathers. Most commercial products contain a blend of both down and feathers; the higher the proportion of down, the higher the value of the product (1).

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The feathers making up the body covering of birds are a specific product of ectoderm, epidermis, and dermis. Formation of all follicles and the initial feathers occur during embryo development, and then feathers are continuously shed and resynthesised throughout the life of domestic fowl (2,3).

To obtain feathers and down at the time of slaughter, the normal process is first to scald the goose in hot water (60-68 °C) for 1-3 min. The coarse feathers of the wing and tail are then removed by hand with the remainder of the feathers and down removed either by a plucking machine or by hand. The feathers are then dried and this is normally done in large commercial tumble dryers. For small amounts, the feathers are spread and stirred frequently to facilitate their drying. In addition to plucking after slaughter, feathers can also be harvested by plucking the geese while they are alive. Although this practice is sometimes criticised because of its apparent cruelty, this is not the case since almost all birds have a natural cycle of growth, maturation, and moulting. A good way to determine the appropriate time for plucking is to test the bird by pulling out a few feathers. If there are no blood marks, it is the natural moulting period and the right time to pluck (1,4).

Factors influencing feather and down production might be effective throughout the life of birds and also during slaughter and feather process. Species, breed, body weight, body measurement, feeding system, management conditions, and some technical processes are among these factors (3). Toth et al. (5) mentioned a correlation (0.50) between body weight and total plucked feathers in geese. Szado et al. (3) defined the same correlation coefficient (0.60) but he also reported that there were no differences among the breeds in terms of amount of feather product related to 1 kg liveweight. The age and sex of geese also affect raw feather and down (5-7).

Goose rearing is a geographically restricted livestock activity in Turkey and the largest population is located in north-east Turkey. Although geese are generally kept for their meat, breeders often use the feathers and down for domestic purposes. Several studies were conducted to determine the production traits of native Turkish geese but feather production was mentioned only as a part of slaughter characteristics without dealing with it in detail (8-10). Therefore, there is no specific information about feather and down production in native Turkish geese.

The purpose of the study was to determine the feather and down production of native Turkish geese and to investigate the effects of age, sex, and feather colour on these traits. To define the relationship between body measurements and feather-down yield was another aim.

Materials and Methods

Animal Material and Process

This study was performed on the farm at Kafkas University in 2002-2003. In total 145 native Turkish geese from the Kars region were used. The geese included were 10 and 12 weeks of age, of both sexes, and had different feather colours (black, white, piebald, and yellow). Traits of the geese were investigated until 12 weeks because of the slow growing character of native Turkish geese. Distributions of the birds according to factors are presented in Table 1. Age was determined according to the time between hatching and slaughter (10 or 12 weeks), sex was defined during evisceration after checking the genital organs (testes or ovaries), and feather colour was identified according to the dominant colour of the birds. Before the bleeding, slaughter weights of the geese were recorded and all the body measurements were obtained according to Szabone Willin and Erzsebet (11) after the bleeding process.

Table 1. Distribution of the geese according to investigated factors.

10 Weeks of age	Male	Female	Total
Black	10	8	18
White	9	10	19
Piebald	11	9	20
Yellow	8	9	17
Total	38	36	74
12 Weeks of age			
Black	8	9	17
White	10	7	17
Piebald	8	11	19
Yellow	11	7	18
Total	37	34	71
General Total	75	70	145

Body measurements consisted of body length, trunk length, chest depth, chest girth, and chest width. Total feather yield was determined for each bird after dry plucking by hand. Then total feathers were separated into hard (feather) and soft (down) and the weights of these products were recorded for each goose.

Statistical Analyses

The General Linear Model was applied to the dataset in order to evaluate the traits. Age, sex, and feather colour of the geese were included in the model as fixed effects. Significant differences between the groups were defined by Tukey test. Relationships between the traits and factors were described by correlation analyses. The Minitab statistical package was used for both analyses.

Results

Effects of age, sex, and feather colour on the traits were analysed and are presented in Table 2. All the factors investigated had significant effects on the traits

studied. Geese at 10 weeks of age yielded heavier feathers than those at 12 weeks of age, while the latter group produced more down. As detected in down weight, the older group has the greater amount of total feathers ($P < 0.01-0.001$). Male geese produced significantly heavier feathers and down than females ($P < 0.05-0.001$). Significant differences were also determined among the feather colour groups ($P < 0.05-0.001$). While black geese produced the heaviest feathers, yellow geese produced the heaviest down. White geese generated the lightest weights for all the products and caused significant differences among the colour groups, since differences among the other groups (black, piebald, and yellow) were not statistically significant ($P > 0.05$).

The relationships between the traits and liveweight and body measurements determined with correlation analyses and the correlation coefficients are presented in Table 3. Correlation analyses gave a chance to define the relationship between liveweight and body measurements, and the correlation coefficients are given in Table 3. The

Table 2. Effects of age, sex, and feather colour on feather production in native Turkish geese.

	Feathers	Down	Total
Age	**	***	**
10 Weeks	100.5 ± 2.5	101.6 ± 3.5	202.1 ± 4.6
12 Weeks	90.4 ± 2.6	132.1 ± 3.6	222.9 ± 4.8
Sex	*	***	***
Male	100.3 ± 2.6	129.3 ± 3.7	229.5 ± 4.8
Female	90.6 ± 2.7	104.9 ± 3.9	195.5 ± 5.0
Feather Colour	***	*	***
Black	104.2 ± 3.2 ^a	121.6 ± 4.6 ^{ab}	225.8 ± 6.0 ^a
White	79.8 ± 3.4 ^b	104.4 ± 4.9 ^b	183.8 ± 6.3 ^b
Piebald	98.8 ± 3.9 ^a	114.3 ± 5.5 ^{ab}	213.0 ± 7.2 ^a
Yellow	99.4 ± 4.3 ^a	127.9 ± 6.1 ^a	227.3 ± 8.0 ^a

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, (a,b,c) = Differences between groups with the same superscripts are not significant ($P > 0.05$).

Table 3. Correlation coefficients between feather production and liveweight and body measurements in native Turkish geese.

	Body length	Trunk length	Chest girth	Chest width	Chest depth	Feathers	Down	Total
Liveweight (g)	0.67	0.70	0.69	0.51	0.32	0.36	0.55	0.62
Body length		0.76	0.57	0.58	0.34	0.36	0.47	0.55
Trunk length			0.55	0.62	0.41	0.40	0.32	0.47
Chest girth				0.52	0.16	0.37	0.73	0.75
Chest width					0.48	0.51	0.36	0.54
Chest depth						0.30	0.21	0.31

strongest correlations were found between feather and chest width (0.51), down and chest girth (0.73), and total feather weight and chest girth (0.75). The weakest correlations were identified between chest depth and the traits (0.21-0.31). Reasonable correlations were found between liveweight and the traits (0.36-0.62). Plucked total feather formed about 5.96% of liveweight in native Turkish geese at the ages investigated. In addition to these results, moderately high correlations (0.51-0.70) were detected between the liveweights and body measurements.

Discussion

The present study examined feather and down production and the factors affecting it in native Turkish geese.

An effect of age on feather and down amounts in geese has been reported by many researchers (2,11). Surprisingly, age inversely affected feather and down in this study: while feather weight was heavier in young geese (10 weeks), down weight was greater in the older group (12 weeks). This initially seems slightly odd but it is related to the progress of feather and down. It can be confidently said that different types of feathers attain maturity at various time. Down reaches maturity first; feathers follow (3). Before maturity, the inner canals of the feather, which were especially on the back and wings, are full of blood and intercellular liquid; therefore, raw feathers are heavier than mature feathers. This information shows that feathers from the geese at 10 weeks of age were rawer than those from geese at 12 weeks of age, and that is why younger geese gave the heavier feather weight. However, this characteristic has not been observed in down because it reached the maturity earlier than the feathers, and normally down from the older birds was greater than that from younger birds. Total feather weights for native Turkish geese at the age of 10-12 weeks were reported as 209-230 g by Tilki et al. (10), which is in agreement with the present study (Table 2).

According to reports by several researchers, male geese have more feathers and down than females (5,7,12,13). Parallel findings were observed in this study; means of feather and down weights in male geese were 9.7 and 24.4 g heavier than in females, respectively. Heavier liveweight, longer neck and trunk,

and deeper chest in male native Turkish geese might cause these differences in feather and down production (14).

Although native Turkish geese have not been categorised according to breed or variety, birds with different feather colours can express certain traits at various levels. For example, in this study white geese produced the lightest feather and down weights while the black and yellow ones produced heavier feathers. Szado et al. (3) support this finding, reporting that species and breeds of birds affect the amount of harvested feathers.

Body weight affects the total amount of feathers since plumage constitutes about 6.2% of body weight (3); nearly the same proportion was found in native Turkish geese (5.96%). The correlation coefficient between liveweight and down weight was 0.55. This is similar to the values (0.50 and 0.56) reported by Toth et al. (5) and Szado et al. (3), respectively. Chest measurements played an important role in both relations between the feather-down weights and body measurements. Accumulation of feathers and down around the chest might cause this relation. Additionally the correlation between the liveweight and chest measurement could be an influencing factor in this relation (Table 3). As demonstrated in Table 3, correlation coefficients between the liveweight and body measurement can also be used as additional describing information for native Turkish geese.

In conclusion, an experiment was carried out to examine down and feather production in native Turkish geese and to evaluate the factors affecting it, and notable data were obtained, as explained in the discussion section. Additionally, our study showed that plucking time should be later than 10 weeks for Turkish geese in order to obtain mature feathers. This kind of study is essential for describing the characteristics of indigenous species and breeds. This is not a widely studied subject in Turkey; therefore, the data obtained can be used for the identification of native Turkish geese. After the gathering of data, like in the present study, native Turkish geese can be classified according to breed, variety, or type.

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