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The Domestic Livestock Resources of Turkey: Populations, Production and Pathology of Ducks and Geese

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Abstract: Turkey is home to a broad range of domestic livestock species that includes ruminant and monogastric quadrupeds and at least eight species of poultry. Ducks and geese are minor species of poultry in terms of numbers but are spread over most of the country (with concentrations of geese in the northeast) and are owned mainly by resource-poor smallholder farm families to whom they contribute animal protein and thus improve welfare. Government recognizes only one indigenous breed of each species but there are various colour morphs of both ducks and geese and these show differences in egg weights and growth traits. Some exotic Pekin ducks were imported in 1984 and Muscovy ducks at an unknown time. There were attempts to modify the genome of local geese with imports of Romanola eggs in 1988 and French White eggs in 1992. There has been limited research on disease in the two species. Most production is for home consumption so there is little internal market activity but there have been sporadic exports and exports of duck meat and goose foie gras. Government has a policy statement on duck and goose production but does not support or promote any conservation activities. There are both technical and administrative challenges to improved and increased production of ducks and geese but opportunities exist for enterprise diversification, for new entrants to species that are less costly to keep and produce than many other domestic species and for processing and producing value-added products.

Key words: Waterfowl, indigenous breeds, animal genetic resources, eggs, meat, feathers

INTRODUCTION

Biodiversity, including livestock biodiversity, is an indication of the genetic and economic wealth of a country. As a natural bridge between Europe and Asia, Turkey has been traversed by traders, travelers, treasure seekers and trespassers for thousands of years. The eclectic mix of species and breeds of domestic livestock within Turkey's boundaries is partially a result of these exchanges. The country is home to four species of ruminant, two of camel (as pseudo ruminants), one of pig, three of equine (including the mule), the dog, the cat and the rabbit (Yilmaz and Wilson, 2012). To these quadrupeds may be added at least eight species of poultry. Domestic fowl ("chicken") is overwhelmingly the most important both numerically and economically of the avian species. Turkey is the next most important species. Duck (both common *Anas platyrhynchos* and Muscovy *Moschata cairina*) and goose together are a minor component of poultry although they account for about 25.3 per cent of the group in Southeast Anatolia (Sakarya *et al*., 2008). There is also sufficient interest in the two species for them to be the subject of at least three textbooks (Selcuk *et al*., 1983; Selcuk and Akyurt, 1986; Kocak and Yalcin, 1993). Other poultry species kept for production, as a hobby or for experimental purposes include pigeons (Yilmaz *et al*., 2013), pheasants (Kececi and Col, 2011) and Japanese quail (Oguz and Parlatt, 2004). Poultry meat and eggs provide an average of 40 per cent of animal protein to the human diet in Turkey's rural areas in the range 25-60 per cent (McLeod, 2007). This paper is one of a series on the domestic livestock of Turkey and provides a review and bibliography of duck and goose production in the country.

Production systems: Duck and geese production is almost entirely of the free range back yard type with almost all output being for home consumption (Selkuk and Akyurt, 1986; Testik, 1997). There are, however, some small commercial Pekin duck enterprises (Testik, 1995) and some semi-intensive production of geese (GDAR, 2004). Goose production is sometimes not considered compatible with agriculture as geese can cause damage to crops (Selcuk and Akyurt, 1986).

Management and husbandry practices have been shown to affect the welfare of ducks and the profitability of the enterprise. Providing access to open water has been shown to have positive effects on welfare but a more intensive system yielded higher financial returns (Demir *et al*., 2010).

Geese are commonly fattened by smallholder farmers in East Anatolia and about half of all goose meat is

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produced in Ardahan and Kars Provinces (Aral and Aydin, 2007; Kirmizibayrak *et al*., 2011). Limited fattening usually starts in spring under extensive conditions when birds are about 1 month old. Later in the year they are transferred to intensive feeding for about 1 month before they are slaughtered mainly for home consumption although some are sold alive or as meat in local markets. A more intensive system of fattening takes place on some specialized farms and where young birds are fed for about 14 weeks and then slaughtered when they weigh about 6 kg (Aral and Aydin, 2007; Turhan and Saricaoglu, 2011). Meat from geese killed in autumn is preserved, either pickled or dried and smoked, for winter use. In Samsun Province two products, known as 'kaz batirmasi' and 'kaz asthma' are renowned local delicacies (Turhan and Saricaoglu, 2011).

Genetic resources: An official source indicates there is one locally adapted or native breed for each of duck and goose and one exotic breed of duck (Pekin) (GDAR, 2004). The goose breed is said to be at risk but both it and the exotic duck are widely used in production (GDAR, 2004).

Pekin ducks were first imported in 1984 with the arrival of 46 000 ducklings (Turkoglu, 1993). Attempts to modify the genotype of local geese started in 1988 with the import (under the auspices of FAO) to Erzurum and Kars Provinces of 12 000 eggs of the Romanola breed from Italy (Saghy, 1994). This first attempt failed due to low egg output and poor hatchability (Tilki and Inal, 2004b). A further import of 2040 French White (from the Rouen station of the Institute National des Recherches Agronomiques) goose eggs from France to the Kars Goose Breeding Station was made in 1992 but this attempt was effectively also a failure as the station was closed in 1997 (Tilki and Inal, 2004b). Some geese were transferred to the Faculty of Veterinary Science at Kafkas University but these were later slaughtered as they were infected with tuberculosis. Some French white were still being raised at the Faculty of Veterinary Science at Selcuk University in Konya Province in the early 2000s (Tilki and Inal, 2004b) and a few crossbreeds of French White and native goose can be seen in the Kars region (Orhan Yilmaz, pers.obs.)

In spite of the official "one breed" concept several distinct populations of duck and goose have been identified (Isguzar and Testik, 1999) although it seems these may be little more than colour morphs (Fig. 1, 2). In Isparta Province 'boz' (= grey), 'yesilbas' (green head but generally known as mallard) and 'kara' (black) types of common duck (generically known as 'ordek') have been distinguished as well as Black Muscovy, Black-white Muscovy and White Muscovy (Isguzar, 2005). As for ducks, unofficial as distinct from official sources have identified several local ecotypes of geese. Thus, in the Sparta Region five types have been identified as 'kara' (= black), 'beyaz' (white), 'şam' (yellow [also known as Damascus]), 'alaca' (piebald) and 'tülü' (feathery) (Isguzar and Pingel 2003). 'armutlu' (pear), 'tatlicak' (sweetish) and 'başkuyu' (baskuyu) types have also been identified (Tilki and Inal, 2004b).

Numbers and distribution: Duck numbers were estimated at about 480 000 and geese numbers at about 500 000 in 1961 (FAOStat, 2012). Over the succeeding 30 years there was a steady increase in the numbers of both species such that in 1991 duck numbers were about 860 000 and geese numbers about 1 400 000. There then followed a period of more rapid increase in numbers of geese whose population reached about 1 800 000 in 1997 at which level it remained until the year 2000. Duck numbers continued to increase steadily throughout the 1990s followed by what appears to be an anomaly in the data which gives their population as 1 500 000 in 1998, 1 100 000 in 1999 and 1 040 000 in the year 2000 (FAOStat, 2012). One official source (GDAR, 2004) gave the number of ducks as 1.104 million and geese as 1.497 million in 2001. In the twenty-first century there has been a rapid decline in the number of ducks to 380 000 in 2010 and a slightly less rapid one in goose numbers to 1.060 million (Fig. 3).

Ducks are kept throughout the country: Geese are also kept to some extent throughout the country but there are heavier concentrations in areas with especially cold winters where temperatures as low as minus 40° Celsius may occur regularly. Thus goose raising is especially focussed in East and Central Anatolia and particularly in Mus, Kars and Ardhan Provinces (Table 1) with smaller concentrations in the central Aegean region (Aral and Aydin, 2007; Turhan and Saricaoglu, 2011; Boz *et al*., 2012).

Fig. 1: A 'yesilbas' (green head or mallard) drake in a group of 'ordek' (common duck) on a private farm in Amasya Province in eastern Anatolia

Fig. 2: Geese of the 'beyaz' (white) and 'ala' (piebald) colour morphs on a private farm in Amasya Province in eastern Anatolia

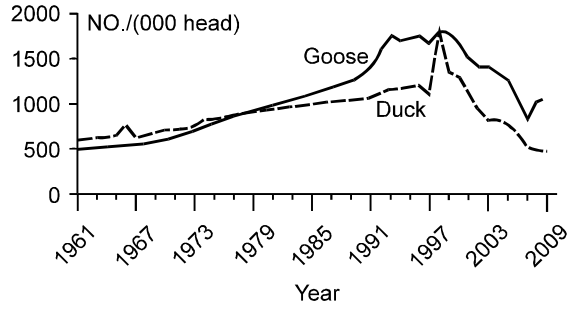

Fig. 3: Dynamics of duck and goose populations in Turkey, 1961-2010 (Source: FAOStat 2012)

Production: The relative importance of various outputs differs according to the species. The value of products from ducks comprises 15 per cent meat, 10 per cent eggs, 15 per cent "culture" (hobby), 20 per cent feathers and 40 per cent environmental management. For geese the values are meat 10 per cent, eggs 10 per cent, culture 20 per cent, feathers 40 per cent and environmental management 20 per cent (GDAR, 2004). Duck meat production in Turkey in 2000 was 4 tonnes whereas that of the goose was 12 tonnes (GDAR, 2004): these data presumably refer to marketed rather than total production. Meat production data for other years vary widely-for example, 464 tonnes in 1996, 106 tonnes in 1998, 24 tonnes in 1999 and 5 tonnes in 2005 (Aral and Aydin, 2007) and it is likely that information on this aspect of animal production is not collected systematically.

There have been several studies of egg production, growth and carcass yield and meat quality of ducks (Testik *et al*., 1988; Turkoglu, 1993; Karaman and Testik, 1995; Karaca *et al*., 1996; Isguzar *et al*., 2002; Isguzar, 2005; Demir *et al*., 2010). Similar exercises have been undertaken for geese (Marasli *et al*., 1996; Arslan and Saatci, 2003a, b; Isguzar and Pingel, 2003; Tilki and Inal, 2004a,b,c; Tilki *et al*., 2004; 2005; Saatci *et al*., 2005; 2009; Saatci and Tilki, 2007; Sahin *et al*., 2008; Celik and Bozkurt, 2009; Tilki *et al*., 2009; Arslan and Tufal, 2011; Tilki *et al*., 2011a, b; Yakan *et al*., 2012).

Egg weights of 'boz', 'yeşilbaş' and 'kara' local ducks have been shown under experimental conditions to be similar to those of Pekin but lighter than black Muscovy, black-white Muscovy and white Muscovy with all being within the range 68.6 g to 76.3 g (Table 2) (Isguzar, 2005). Hatching weights of these types were in the range of 41.7 g to 46.2 g but were not directly related to the variation in egg weights (Isguzar, 2005). These egg and hatching weights are similar to those found in other Turkish studies (Testik and Karaca, 1991; Karaman and Testik 1995; Karaca *et al*., 1996) but it appears that eggs

Table 1: Geese numbers and percentage distribution in Turkish provinces, 2000-2010

	Year					
	2000		2005		2010	
Province	No.	(%)	No.	(%)	No.	(%)
Mus	172 000	11.5	111 145	10.4	101 840	14.2
Kars	110 350	7.4	140 194	13.1	96 480	13.5
Ardahan	97 680	6.5	142 000	13.3	126 133	17.6
Yozgat	87 400	5.8	34 212	3.4	33 328	4.7
Samsun	62 880	4.2	43 656	4.1	32 468	4.5
Agri	44 600	3	31 200	2.9	15 866	2.2
Afyon	36 420	2.4	26 830	2.5	27 495	3.8
Konya	36 780	2.7	57 062	5.3	17 023	2.4
Erzurum	32 390	2.2	22 788	2.1	15 198	2.1
Sanliurfa	27 900	1.9	35 300	3.3	15 344	2.1
National total	1 496 604	100	1 066 581	100	715 555	100

Source: Boz *et al*. (2012)

Table 2: Some egg, growth and carcass characteristics of Turkish ducks

	Egg weight	Live weight (g)				Dressing	Percentage of Breast+leg
Genotype	(g)	Hatching	4 weeks	8 weeks	12 weeks	percentage	to carcass
Local 'boz'	68.6	41.7	1126	1922	2064	73.7	33.8
Local 'yeşilbaş'	71.5	42.6	1140	1822	2000	72.5	34.1
Local 'kara'	71	43.9	1039	1648	1800	71.5	34.3
Pekin	71.5	45.8	1174	1747	1890	71.3	36.7
Black Muscovy	73.3	41.8	-	-	-	-	-
Black-White Muscovy	76.3	46.2	-	-	-	-	-
White Muscovy	75.5	42	-	-	-	-	-

Source: adapted from Isguzar *et al*. (2002), Isguzar (2005)

from local ducks under scavenging conditions are lighter and in the range 54.8 g to 64.2 g (Iszugar and Testik, 1999). Fertility was in the range 33.5 per cent to 78.5 per cent with black-white Muscovy ducks showing by far the lowest value. Hatchability of fertile eggs was in the range 31.7 per cent to 48.6 per cent with no clear trend among local, Pekin and Muscovy ducks (Isguzar, 2005). Fertility and hatchability data are again similar to other Turkish studies (Testik and Karaca, 1991; Turkoglu, 1993; Karaman and Testik, 1995; Karaca *et al*., 1996). Growth in Turkish local ducks shows the typical pattern of very rapid early gains up to 4 weeks with a subsequent slowing down (Table 2). 'boz' and 'yeşilbaş' types reach about 2 kg at 12 weeks with the 'kara' and the Pekin weighing about 1.8 kg, there being significant differences in genotype and sex (Isguzar *et al*., 2002). Other studies have shown that Pekin ducks in Turkey have reached 2.5 kg at 12 weeks (Testik *et al*., 1988). Protein contents of meat are similar in local and Pekin ducks at about 20 per cent but local ducks have significantly lower fat content and therefore may have possibilities for cross breeding for genotypes with reduced fat (Isguzar *et al*., 2002).

The 'boz' type has the greatest dressing percentage (carcass weight including edible offal) among the three local common and Pekin ducks (Table 2). Turkish Pekin males have, however, a significant advantage in the percentage of breast and leg to total carcass weight in comparison with the local types. The percentage of breast meat in Turkish studies tends to be higher than for other ducks but this is probably due the 12-week slaughter age as, although overall growth slows down at an early age, the breast continues to grow relatively faster. Percentages of heart and liver do not differ among genotypes but for unknown reasons gizzard percentages between 'kara' and 'boz' ducks were different (Isguzar *et al*., 2002). Dressing percentages of 71.3-73.7 per cent are considerably reduced if offals are not included. In an earlier study the contributions to total carcass weight of bone was 28 per cent, for skin was 38 per cent and for meat was 34 per cent (Kocak and Yalcin, 1993). Percentage of heart to total carcass weight was 0.7 per cent and of liver was 2.9 per cent. Highest percentages of protein-which overall is about 20 per cent-were found in Turkish Pekin in breast and leg meat and in 'kara' meat. Fat percentages of the carcass differed considerably among genotypes with that of Pekin ducks (~15 per cent) being two and half times greater than that of the 'yesilbas' (~6 per cent) local type, about twice that of the 'boz' (~7-8 per cent) and one and one half times that of the 'kara' (~10 per cent) type (Isguzar *et al*., 2002).

Geese in Turkey are kept to produce meat and feathers and down. Foie gras is produced to a limited extent (Aral and Aydin, 2007; Turhan and Saricaoglu, 2011). The laying period is from January/February to June/July with individual geese laying 8-60 eggs over a period of up to

Table 3: Some egg, growth and carcass characteristics of Turkish geese

Genotype	Egg weight (g)	Live weight (g)					Dressing percentage
		Hatching	3 weeks	5 weeks	9 weeks	12 weeks	
'kara' (white)	147.8	89.9	565.8	1167.4	2427.9	2728.6	70.7
'beyaz' (black)	150.5	77.9	486.3	998.9	2102.6	2442.6	70.7
'şam' (yellow)	148.4	92.4	589.9	1275.8	2350.4	2752.3	70.6
'ala' (piebald)	150.9	71.5	476.9	1203.5	2175.9	2433	-
'tülü' (tissue)	-	86.2	458.2	1267.4	2145.1	2543.3	-

Source: adapted from Isguzar *et al.* (2002), Isguzar and Pingel (2003), Isguzar (2005)

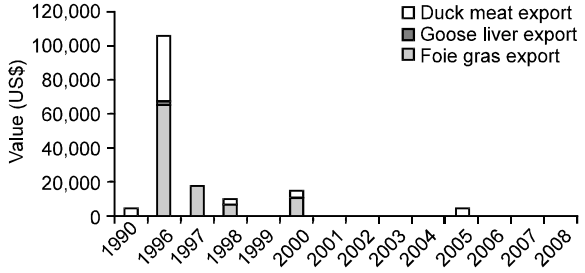

Fig. 4: Exports from Turkey of duck meat and livers and foie gras, 1996-2008

130 days. Fewer eggs are laid by young geese being 8.1 for 1-year-old birds and 12.2 for 2-years-old (Arslan and Saatci, 2003b). Egg weights of these young birds were 144.2 g, fertility was 60.5 per cent and hatchability was 22.2 per cent. Some geese continue laying until 10 years of age with egg weights of older birds being as much as 200 g (Aral and Aydin, 2007). The higher number laid by Turkish geese is more than the 15-20 eggs per year of many other types (Buckland and Guy, 2002). A total of 512 eggs collected in 2001 and 2002 from four colour variants of native geese aged 3-4 years at the Faculty Farm of Kafkas University, Kars had an overall mean weight of 148.43 g (Table 3). There were significant differences in egg weight related to colour with eggs of yellow birds being heavier than those of all other types (Saatci *et al.*, 2005). Egg weight was significantly correlated with hatching weight which averaged 96.12 g overall, although goslings hatched from 'şam' eggs weighed less than the other three types.

Turkish geese are rather small with mature weights generally being in the range of 3 to 6 kg (Ilaslan and Askin, 1976; Selcuk *et al.*, 1983; Tilki *et al.*, 2005). In common with most domestic waterfowl, early growth is very rapid but slows down quickly from about 12 weeks of age (Tilki *et al.*, 2009). In one feeding experiment involving 50 native geese from Diyarbakir province geese that weighed 2908 g at the end of the experimental period has gained 33 g/day for a feed intake of 144.4 g/day at a feed conversion ratio of 5.5 (Arslan and Tufan, 2011). Weights of five different colour morphs showed significant differences among them and there were also differences between males and females (Iszugar and Pingel, 2003). The overall average weight of all morphs combined at 12 weeks was about 2.5 kg with 'kara' and 'şam' being heaviest and 'beyaz', 'ala' and 'tülü' lightest (Table 3). Relationships between body weight and linear measurements of several body parts have been shown to be significant (Saatci and Tilki, 2007).

Geese from four different areas showed statistically significant differences in several carcass and slaughter parameters (Tilki and Inal, 2004c). Overall carcass weights for geese slaughtered at 104 weeks averaged 69.3-71.6 per cent of live weight (Table 3) with breast and leg combined contributing almost half of this (Iszugar and Pingel, 2003). Protein contents were in the range 18-22 per cent and fat contents were very low at less than 1 per cent .

Feathers and down are used locally in padded winter clothing, in mattresses, pillows, bed quilts and in soft furnishings. A study of feather and down production was undertaken on 145 geese of four different colours from the Kars Region. Males produced a total greater weight of feather and down than females and there were also differences in production among the colour types. At 12 weeks of age male feather production was 100.3 g and that of down was 129.3 g. Female feather production at the same age was 90.6 g whereas that of down was 104.9 g (Saatci, 2008). It has been estimated that feather and down production could be as much as 25 tonnes per year in Ardhan Province (Aral and Aydin, 2007).

Under conditions of force feeding liver weights can increase from 80 g at 9 weeks to 600-1000 g at 25 weeks (Aral and Aydin, 2007).

In an experiment involving 14 Turkish geese there was no significant improvement in eggshell thickness and weight following supplementation with $NaHCO_3$ (sodium bicarbonate) but results indicated that supplementation may support the maintenance of venous blood pH, base excess, HCO_3-, pCO_2 and tCO_2 levels at the physiological ranges which are required for normal health and production status of the goose during the laying cycle (Kaya *et al.*, 2004).

Pathology: Lesions of nodular type were seen in the liver, spleen and lungs of seven geese that died at the breeding unit of the Faculty of Veterinary Medicine of

Kafkas University. Histopathological examination revealed that lesions were characterized by central areas of caseous necrosis surrounded by epithelioid cells, multinucleated giant cells, lymphocytes and an outer fibrous capsule. Acid-fast bacilli were identified by the Ziehl-Neelsen staining method in paraffin sections and smears and inoculation into Lowenstein-Jensen media with glycerin yielded *Mycobacterium* spp. (Ozcan *et al*., 2001).

Severe degeneration of kidney tubular epithelium and congestion of kidney and liver tissues were observed in three geese that had been poisoned by voluntary intake of ethylene glycol (anti-freeze) showing that nitrosative tissue damage and apoptotic cell death takes place in kidney and liver during ethylene-glycol intoxication in geese (Ozcan *et al*., 2007). The lungs and air sacs of 19 goslings were the main sites affected by pulmonary and systemic aspergillosis and were generally characterized by diffuse yellowish-white granulomas. Numerous fungal hyphae were found within the necrotic debris of the granulomas which in some cases extended to the serosal linings of the gastrointestinal and upper respiratory tracts, to the liver, spleen and kidneys and in two cases also to the bursa of Fabricius, musculus (m.) longus colli and adventitia of the aorta (Beytut *et al*., 2004). Pulmonary aspergillosis was also identified in geese aged 2-13 weeks in Kars Province (Turkutanit, 1999).

Highly Pathogenic Avian Influenza (HPAI caused by the H5N1 virus) was confirmed in ducks in Dogubayazit in Agri Province near the Armenian and Iranian border in January 2006. Two deaths in young children were related to this outbreak (Akpinar and Saatci, 2006). The Turkish Government acted swiftly to contain the outbreak with almost 14 million domestic birds being destroyed for which compensation was paid at the rate of 20 Turkish Lira for turkeys, 10 Turkish Lira for ducks and geese and 5 Turkish Lira for domestic fowl and pigeons: other actions to prevent the spread of disease included an order that birds must be confined in-doors and a permanent ban on sales of live poultry at markets (Yalcin, 2006). Sporadic outbreaks of H5N1 continue to be reported over a wide area of Turkey.

Markets and trade: There is little internal marketing of duck and geese products as almost all production is for home consumption.

There has been sporadic export and import trade in duck meat, duck liver, goose liver and foie gras with 1996 being the outstanding year with 66 tonnes of duck meat valued at US$ 66 000 and 20 tonnes of foie grass valued at US$ 39 000 being exported (Fig. 4). A complete ban on imports of live birds and poultry products from Turkey to the European Union was adopted in early October 2005 and remains in place in late 2012 (EU, 2012).

Policy issues: Official policy at the beginning of the 20th century was "Through the improvement of poultry production, consumption and export of broiler, turkey and duck meat as well as egg should be encouraged." (GDAR, 2004).

Turkey has a broad ranging series of projects covering improvement and conservation of many of its indigenous domestic animals (Arat, 2011) but neither ducks nor geese are included in these activities.

Challenges and opportunities: The challenges facing duck and goose production include lack of technical knowledge by producers and government support services alike, no formal marketing system, unavailability of financial resources for improvement and development and improvement of the quality and safety of products.

The local duck and goose genotypes are suitable for meat production not only for current and home use but also to contribute to niche markets because of low fat contents of the meat. They can add to diversification of existing production and thus reduce the risks associated with a narrow base. Ducks and geese are very suitable for use in integrated systems that, for example, make use of by-products from other enterprises and in pond based systems that produce fish. There are good opportunities for producing value added products such as foie gras and down and feathers which continue to have high demand on both external and internal markets. They demand little in the way of capital investment in semi-intensive improved systems and produce rapid returns if managed and marketed correctly.

REFERENCES

Akpinar, E. and E. Saatci, 2006. Avian influenza in Turkey-will it influence health in all Europe? Croat Med. J., 47: 7-15.

Aral, Y. and E. Aydin, 2007. The economic importance of goose breeding and an assessment of possible goose products in Turkey. Veteriner Hekimler Dernegi Dergisi, 78: 31-38.

Arat, S., 2011. *In vitro* Conservation and Preliminary Molecular identification of some Turkish Domestic Animal Genetic Resources (Turkhaygen-I). Genetic Engineering and Biotechnology Institute: Gebze Kocaeli, Turkey.

Arslan, C. and M. Saatci, 2003a. Bulky feeds in the intensive fattening of goslings. I. Effects of grass, alfalfa and sugar beet pulp on growth, slaughter performance and some blood parameters in geese. Rev. Med. Vet., 154: 633-638.

Arslan, C. and M. Saatci, 2003b. Egg yield and hatching characteristics of geese raised in Kars Region. Turk. J. Vet. Anim. Sci., 27: 1361-1365.

Arslan, C. and T. Tufan, 2011. Fattening performance, slaughter traits and some blood parameters of native Turkish geese fed under semi-intensive conditions. Kafkas Universitesi Veteriner Fakultesi Dergisi, 17: 487-491.

Beytut, E., K. Ozcan and S. Erginsoy, 2004. Immunohistochemical detection of fungal elements in the tissues of goslings with pulmonary and systemic aspergillosis. Acta Veterinaria Hungarica, 52: 71-84.

Boz, M.A., U.S. Yamak and M. Sarica, 2012. Goose production in Turkey and experiments at Yozgat City. Uluslararasi Turk ve Akraba Toplulukları Zootekni Kongresi, 11-13 Eylul 2012, Isparta, pp: 272-280.

Buckland, R. and G. Guy, 2002. Goose production (Animal Production and Health Paper No 154). Food and Agriculture Organization: Rome.

Celik, B. and Z. Bozkurt, 2009. Slaughter and carcass traits of native geese reared in Mus Province. Lalahan Hay. Arast. Enst. Derg., 49: 37-46.

Demir, P., Z. Erisir, O. Poyraz, E.E. Onbasilar and E. Erdem, 2010. Cost-benefit analyses of Pekin duck fattening according to various housing systems and slaughter age. Kafkas Universitesi Veteriner Fakultesi Dergisi, 16: 493-496.

EU, 2012. Avian influenza in Turkey: EU takes further import measures. Accessed on 14 December 2012 at http://www.eu-un.europa.eu/articles/en/article_5544_en.htm.

FAOStat, 2012. FAO Statistical Year Book 2012. Food and Agriculture Organization: Rome. http://faostat3.fao.org/home/index.html.

GDAR, 2004. Turkey Country Report on Farm Animal Genetic Resources. General Directorate of Agricultural Research, Ministry of Agriculture and Rural Affairs: Ankara.

Ilaslan, M. and Y. Askin, 1976. Investigations on the some economical characteristics of Kars region's geese in Turkey. J. Ankara Univ. Fac. Agric., 26.

Isguzar, E., 2005. Some egg and hatching traits of local ducks, Turkish Pekins and Muscovy ducks in Isparta/Turkey (short communication). Arch. Tierz., Dummerstorf, 48: 94-100.

Isguzar, E. and H. Pingel, 2003. Growth, carcass composition and nutrient content of meat of different local geese in Isparta region of Turkey. Arch. Tierz. Dummerstorf, 46: 71-76.

Isguzar, E. and A. Testik, 1999. An investigation on local genotypes of waterfowl in Isparta province of Turkey. Proceedings of the 12th European Symposium on Waterfowl, pp: 51-56.

Isguzar, E.C. Kocak and H. Pingel, 2002. Growth, carcass traits and meat quality of different local ducks and Turkish Pekins (short communication) Arch. Tierz. Dummerstorf, 45: 413-418.

Karaca, O., H. Okut and T. Altin, 1996. The estimation on some parameters of Pekin ducks's egg productions. I. National Congress of Zootecny: Ankara, Turkey.

Karaman, M. and A. Testik, 1995. The study of effects on hatching and growth performances of Pekin ducks's different weight eggs. Proceedings of the International Congress of Poultry Husbandry, Istanbul, pp: 485-492.

Kaya, I., B. Karademir and O. Ucar, 2004. The effects of diet supplemented with sodium bicarbonate upon blood pH, blood gases and eggshell quality in laying geese. Veterinarni Medicina (Czech Republic), 49: 201-206.

Kececi, T. and R. Col, 2011. Haematological and biochemical values of the blood of pheasants (*Phasianus colchicus*) of different ages. Turkish J. Vet. Anim. Sci., 35: 149-156. doi:10.3906/vet-0910-135.

Kirmizibayrak, T., K. Onak and K. Yazici, 2011. Effects of age and sex on slaughtering and carcass characteristics of Turkish native geese reared in free range production conditions in Kars Province. Kafkas Universitesi Veteriner Fakultesi Dergisi, 17: 41-45.

Kocak, C. and S. Yalcin, 1993. Duck Raising. Ege University Press: Izmir, Turkey.

Marasli, N., S. Marasli, A. Ozcan, N. Utlu, N. Acar and D. Celikler, 1996. Biochemical studies on geese fed with barley and goose rearing feed. I. The effects of feeding with barley and geese rearing feed on th relationship live weight gain and serum lipid levels. Kafkas Universitesi Veteriner Fakultesi Dergisi, 2: 65-68.

McLeod, A., 2007. Social impacts of structural change in the poultry sector. In: Conference on Poultry in the 21st century, 5-7 November 2007, Bangkok.

Oguz, H. and S.S. Parlat, 2004. Effects of dietary mannanoligosaccharide on performance of Japanese quail affected by aflatoxicosis. South African J. Anim. Sci., 34: 144-148.

Ozcan, K., E. Beytut, F. Aydin and M. Tuzcu, 2001 Tuberculosis in geese (*Anser anser*) in Turkey. Avian Dis., 45: 475-479.

Ozcan, K., H. Ozen and M. Karaman, 2007. Nitrosative tissue damage and apoptotic cell death in kidneys and livers of naturally ethylene glycol (antifreeze)-poisoned geese. Avian Pathol., 36: 325-329.

Saatci, M., T. Kirmizibayrak, A.R. Aksoy and M. Tilki, 2005. Egg weight, shape index, hatching weight with interrelationship among these traits in different feather coloured Turkish native geese. Turk. J. Vet. Anim. Sci., 29: 353-357.

Saatci, M. and M. Tilki, 2007. Zoometrical body measurements and their relation with liveweight in native Turkish geese. Turk. J. Vet. Anim. Sci., 31: 47-53.

Saatci, M., 2008. Effects of age, sex, feather colour, body measurements and body weight on down and feather yield in native Turkish geese. Turk. J. Vet. Anim. Sci., 32: 293-297.

Saatci, M., M. Tilki, I. Kaya and T. Kirmizibayrak, 2009. Effects of fattening length, feather colour and sex on some traits in native Turkish geese. II. Carcass traits. Arch. Geflügelk, 73: 61-66.

Sahin, T., M. Tilki, I. Kaya Y. Unal, E. Aksu and E.D. Imal, 2008. Effect of different protein levels for finishing period on fattening performance and carcass traits in native Turkish geese. J. Anim. Vet. Adv., 7: 1364-1369.

Saghy, I.E., 1994. Mission Report of Geese Pathologist to Turkey. Veterinary Medical Research Institute, Hungarian Academy of Sciences: Budapest, Hungary.

Sakarya, E., Y. Aral and E. Aydin, 2008. The significance of the Southeastern Anatolian Project and livestock in the development of the Southeastern Anatolia Region. Veteriner Hekimleri Dernegi Dergisi, 79: 35-42.

Selcuk, E. and I. Akyurt, 1986. Duck husbandry (Publication No 8). Ministry of Agriculture and Forestry Press: Ankara, Turkey.

Selcuk, E., I. Akyurt and C. Geliyi, 1983. Goose husbandry. Ministry of Agriculture and Forestry Press: Ankara, Turkey.

Testik, A., 1995. The situation of ducks and geese production in Turkey. Proceedings of the 10th European Symposium on Waterfowl, pp: 43-45.

Testik, A., 1997. Traditional goose production system in the East Anatolian Region (Kars Area) of Turkey. Proceedings of the 11th European Symposium on Waterfowl, 8-10 September 1997, Nantes, France, pp: 519-522.

Testik, A. and M. Karaca, 1991. An investigation on the egg quality traits of Pekin ducks. Proceedings of the International Congress of Poultry Husbandry, Istanbul, pp: 85-91.

Testik, A., E. Peke and M. Sarica, 1988. An investigation on growth performance of Pekin duck. J. Fac. Agric. Cukurova Univ., 3: 14-22.

Tilki, M. and S. Inal, 2004a. Yield traits of geese of different origins reared in Turkey. I. Hatching characteristics. Turk. J. Vet. Anim. Sci., 28: 149-155. (article in Turkish with an abstract in English).

Tilki, M. and S. Inal, 2004b. Yield traits of geese of different origins reared in Turkey. II. Growth traits. Turk. J. Vet. Anim. Sci., 28: 157-163. (article in Turkish with an abstract in English).

Tilki, M. and S.I. Inal, 2004c. Yield traits of geese of different origins reared in Turkey III. Slaughter and carcass traits. Turk. J. Vet. Anim. Sci., 28: 165-171. (article in Turkish with an abstract in English).

Tilki, M., M. Saatci, T. Kirmizibayrak and A.R. Aksoy, 2004. Slaughter and carcass traits of geese raised in Bogazköy-Kars. Kafkas Univ. Vet. Fak. Derg., 10: 143-146. (article in Turkish with an abstract in English).

Tilki, M., M. Saatci, T. Kirmizibayrak and A.R. Aksoy, 2005. Effect of age on growth and carcass composition of native Turkish geese. Arch. Geflügelk., 69: 77-83.

Tilki, M., T. Sahin, M. Sari, S. Isik and M. Saatci, 2009. Effect of age and sex on fattening performance and carcass characteristics of native Turkish geese. Kafkas Univ. Vet. Fak. Derg., 15: 245-250.

Tilki, M., B. Gul, M. Sari, K. Onk and S. Isik, 2011a. Growth, slaughter and carcass traits of native Turkish geese reared under the country-side conditions. Ataturk Universitesi Veteriner Fakultesi Dergisi, 6: 209-215.

Tilki, M., K. Yazici, M. Sari, S. Isik and M. Saatci, 2011b. Effects of hatching month and sex on slaughter and carcass traits in native Turkish geese. Kafkas Universitesi Veteriner Fakultesi Dergisi, 17: 831-835.

Turhan, S. and F.T. Saricaoglu, 2011. The importance and niche of goose meat in Samsun culinary culture. Ondokuz Mayis Universitesi Samsun Sempozyumu.13 Ekim 2011: Samsun, Turkey.

Turkoglu, M., 1993. The investigation on improving of hatching performance of Pekin ducks in Turkey (Publication No 1288). Faculty of Agriculture, Ankara University: Ankara, Turkey.

Turkutanit, S.S., 1999. Pulmonary aspergillosis in Geese. Turkish J. Vet. Anim. Sci., 23: 49-52. (article in Turkish with an abstract in English).

Yalcin, C., 2006. Market impacts of HPAI outbreaks: A rapid appraisal process-Turkey. Paper presented at Symposium on The Market and Trade Dimensions of Avian Influenza, 14 November 2006, Rome, Italy. Food and Agriculture Organization: Rome.

Yakan, A., D. Aksu Elmal, M. Elmali, T. Shi, S. Motor and Y. Can, 2012. Carcass and meat quality characteristics of white and multicolor geese under local breeder conditions. Kafkas Univ. Vet. Fak. Derg., 18: 663-670.

Yilmaz, O. and R.T. Wilson, 2012. The domestic livestock resources of Turkey: Economic and social role, species and breeds, conservation measures and policy issues. Livestock Research for Rural Development: 24(9), Article #157. http://www.lrrd.org/lrrd24/9/yilm24157.htm

Yilmaz, O., T. Savas, M. Ertugrul and R.T. Wilson, 2013. The domestic livestock resources of Turkey: inventory of pigeon groups and breeds with notes on breeder organizations. World's Poult. Sci. J., 69: 265-278.