

Review

The domestic livestock resources of Turkey: Notes on rabbits and a review of the literature

R. Trevor Wilson¹ and Orhan Yilmaz²¹Bartridge Partners, Umberleigh, Devon, UK, ²Department of Animal Science, Faculty of Agriculture, Igdir University, Igdir, Turkey

Abstract

The Turkish wild rabbit is known from ancient times. As a minor component of Turkey's array of livestock and poultry there is no official information on numbers or production. The iconic Angora is the only native breed. Imported breeds include New Zealand White, California, Chinchilla, Line V and French Angora. The Angora is a registered breed and is being conserved *ex situ in vivo*. Official data give Angora weight as 3.5-4.0 kg in males and 4.0-4.5 kg in females, fibre production as 700-800 g from bucks and 1 000 g from does from four clips per year, first breeding age as 6 months, litter size 1-6 kits and production of four litters per year. Production research is limited but generally shows lower fibre output than official data. A comparative study with California and Line V rabbits showed the latter was heavier at birth and grew faster to 10 weeks. The rabbit has been used as an animal model in several studies. There is little information on meat and fibre marketing as there is on international trade but there have been sporadic imports of meat. Pathologies include coccidiosis, mange and myiasis. Constraints include lack of producer knowledge, poor quality feed, inadequate housing and lack of breeding stock. Opportunities lie in public and private support, genetic improvement for fibre for product diversification and increased incomes, improved marketing and niche markets for low cholesterol and low fat meat.

Keywords: Angora fibre, breeds, experimentation, animal model, pathology, diversification

Archiv Tierzucht 56 (2013) 3, 18-27

doi: 10.7482/0003-9438-56-003

Corresponding author:

R Trevor Wilson; email: trevorbart@aol.com

Bartridge Partners, Umberleigh, Devon EX37 9AS, UK

Received: 6 June 2012

Accepted: 15 January 2013

Online: 8 February 2013

© 2013 by the authors; licensee Leibniz Institute for Farm Animal Biology (FBN), Dummerstorf, Germany.

This is an Open Access article distributed under the terms and conditions of the Creative Commons Attribution 3.0 License (<http://creativecommons.org/licenses/by/3.0/>).

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, travellers, 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 camels (as pseudoruminants), one of pig, three of equines (including the mule), at least five of poultry, the dog, the cat and the rabbit (Yilmaz & Wilson 2012). Rabbit production is a minor activity which may be due in part to the prohibition of eating its meat in the Alevi-Bektasi community (Ergun 2011) but the species is used in a variety of ways including the production of fibre and as an animal model for experimentation. Turkish official statistics do not include data on rabbits so information on numbers and production is not generally easy to obtain. This paper reviews the current status and use of the rabbit and is an attempt to gather most of the information available on the species in the published literature.

History

The presence of the wild rabbit in Turkey over a very long period is attested by place names. Legend has it that Mousolos, the king of Halicarnassus (and whose Mausoleum is sometimes considered as one of the wonders of the Ancient World), built a causeway from the Aegean coast of southwest Turkey to an offshore island situated 15 km north of Bodrum in order to feed the rabbits (and to woo his wife and sister Artemisia) whence arose the name of Rabbit (Apostol) Island. Another group of uninhabited islands in the northern Aegean Sea situated some eight kilometres off the coast of Canakkale Province and 12 km to the southwest of the entrance Dardanelles Straits are also known as the Rabbit Islands and comprise a larger (2000 m long and 600 m wide) and three smaller rocky islets. Wild rabbits are still found on these islands, on an island off Aliaga County in Izmir Province, yet another 24 km south of Istanbul (known as Nadros Island in Greek) and on Red Island off Fethiye in western Turkey lying opposite the island of Rhodes.

The Angora (Ankara) rabbit is said to have originated from Ankara in Central Anatolia where its known history ascends to the 18th century. Angora rabbits were presented by the Ottoman Sultan Abdulhamid I (reigned 1774-1789) to the French Queen Marie Antoinette and they became highly regarded by the French court as beautiful pets. Large numbers of Angora rabbits were also taken from Central Anatolia to England in the late 17th century in part to provide fine fibre and then spread to the newly industrializing nations, especially France but also Germany and Belgium early in the 18th century (Ossard *et al.* 1995). Imports of Angora fibre reached 105 tonnes in 1995, up to which time there had not been any local production (Kocak & Taskin 2004).

Genetic resources

Official sources indicate one local breed of rabbit and one exotic, that the local breed is at risk and that the exotic one is widely used for production (GDAR 2004).

Angora rabbits

The local breed is the iconic Angora (Turkish=Ankara Tavsani) and this is registered as Notification Number 2004/39 promulgated in the Government Gazette number 25 668 of 12 December 2004 by the Animal Breeds Registration Committee of the Ministry of Food, Agriculture and Livestock. The national breed catalogue (Anon 2011) limits its distribution to Ankara Province in Central Anatolia and describes it as a dual purpose type for production of wool and meat. Mature body weight is 3.5-4.0 kg in males and 4.0-4.5 kg in females. Kits weigh 47-55 g at birth. The »official« description is: »Body is middlesized. It is a »wool rabbit« with long hairs. It has vertical ears with tassels at the end. Head is middle-sized and circular, neck is short. Bones are slim and strong. Feet are slim and long covered with long hairs. Wool is white, long, slim, dense, soft, bright and convenient for weaving. They are generally calm, when they are kept in cage together in three or older months age, they may harm each other. In case of stress, it may run or knock down its back feet. It tends to swallow its wool. It is the only breed that thread can be produce from its wool. Because of its wool is light, slim and high heat isolation characteristics, it is used in a wide range air industry to medicine.« (Anon 2011).

A Project entitled »The Preservation of Farm Animal Genetic Resources« was established in 1995 to conserve cattle breeds considered at risk. Other farm animal species were included subsequently and the Angora rabbit was added in 2002. Angoras are being conserved *ex situ* but *in vivo* at the Ankara Poultry Research Unit (Anon 2011). An Angora Rabbit Breeders Association was established at one time but this now appears to be moribund or indeed defunct.

Non-native breeds

New Zealand White rabbits were imported by the Ankara Poultry Research Institute in the early 1960s and there were later imports of California and Chinchilla types (Testik 1996). Line V rabbits have also been imported from the Universidad Politecnica in Seville, Spain for experimental purposes (Akin *et al.* 1996, Testik *et al.* 1999).

Exotic (French) Angora rabbits were imported by Erciyes University in Kayseri in 1993. There is now a nucleus of more than 60 breeders raising this strain (Prof. Dr. Tayfur Bekyurek, personal communication) but these must pose a risk for maintaining the purity of the truly indigenous type.

Production and use

The relative value of output stated in an official document for the year 2003 (and presumably for rabbit production as a whole) was 45 % meat, 45 % skins, 5 % fibre and 5 % environmental goods (GDAR 2004). By 2011 the Angora had become a dual-purpose meat and fibre animal with its main product being an annual total 700-800 g of fibre from bucks and 1 000 g of fibre from does from four clips per year (Anon 2011). First breeding age is given as 6 months, litter size 1-6 kits and four litters per year are produced (Anon 2011).

Academic research on Angora and meat rabbits began in the 1990s with some notes on early performance of the latter being published in 1996 (Testik 1996). One study has provided

details of fibre production and quality (Table 1). In an experiment carried out with 53 does and 7 bucks of French Angoras at Erciyes University to determine the effects of shearing on reproductive performance it was found that shearing in summer affected conception rates but shearing at other times of year had no effect on this trait and neither gestation length nor litter size were affected at all. Mean litter sizes of the 53 does varied from 5.4 to 7.8 kits per parturition. Fibre yields of 53 does shorn at 3-4 month intervals and over five clips varied from 50 to 270 grammes per clip with lower yields in younger and older animals than those in the middle age groups. Fibre length ranged from 6 to 18 cm with greatest length occurring at the third shearing. Fibre yields were lower in bucks and staple lengths were shorter than in does but none of these differences was statistically significant (Bekyürek 1998, Bekyürek *et al.* 2005).

Table 1
Some traits of Angora rabbit fibre

Item	Sex		
	Male	Female	Castrate
Fibre production, g	700-800	1000	900
Fibre length, cm	10 -15		
Fibre diameter, micron	11	12	
Fibre specific weight, g/cm ³	1.15 -1.18		
Fibre quality ratio			
More than 6 cm, %	65	75	
Less than 6 cm, %	27	20	
Matted, %	8	5	

Source adapted from Yildirim *et al.* (2005)

A study of 42 Angora farms in 17 locations in 2002 divided holdings into small (less than 50 rabbits), medium (50-200) and large (more than 200) enterprises. The overall average fibre yield per animal per year was 642 g being 728 g on small, 821 g on medium and 575 g on large scale farms. Average annual income from fibre was US\$ 1 112.03 on small, US\$ 3 164.86 on medium and US\$ 6 698.74 on large farms with small farms earning US\$ \$ 20.77 per kg of fibre sold, medium farms US\$ 73.38 and large farms US\$ 24.93 (Artukoglu *et al.* 2007).

Treating Angora fibre with ozone increases its whiteness and dyeability with best degree of whiteness and colour yields being obtained by ozonation at 23-25 °C with water at pH 7 and 60 % water pickup value (Perincek 2008). Feeding 2 mg/kg live weight of doxorubin for three weeks to reduce fibre loss in Angoras resulted in a fibre weight increase of 167 % between weeks 2 and 5 (Powis & Kooistra 1987).

A total of 25 New Zealand White rabbits was used to determine whether some weight parameters could be used as a proxy for pregnancy. The rabbits were kept in two different rabbitries and pregnancy was diagnosed by abdominal palpation. The pregnancy rate was 60 %. Mean weight gain did not differ between pregnant and non-pregnant rabbits. It was concluded that weight was neither a reliable nor a clear indicator for pregnancy determine in rabbits (Akar & Canooglu 2006).

In a comparative study of birth weights and growth rates of California and Line V rabbits the latter group was heavier at birth and showed superior daily gains to 3, 6, 8 and 10 weeks. It was concluded that there were good possibilities of improving further the productivity of exotic as compared to native breeds under the hotter conditions of Turkey even though

native rabbits were better adapted to these conditions (Testik *et al.* 1999). (It should be noted, however, that the general recommendation in Turkey is to rear Angora rabbits in cooler areas as heat reduces the production of fibre.)

Investigations were carried out on New Zealand White, California and Chinchilla rabbits to determine the effects of rations containing high protein, low protein and substituting urea for protein on feed conversion efficiency. The results showed that the California and New Zealand Whites performed better than the Chinchilla (Demirel & Fidan 1999).

The effects of genotype, sex and age on slaughter and carcass characteristics of 52 White New Zealand and 17 California rabbits have been studied. The age effect was significant ($P<0.01$) traits. Genotype had a significant effect ($P<0.01$) on slaughter and carcass traits except for liver, kidney, heart and stomach weights. Sex was not significant in any trait (Akinci *et al.* 1998).

Studies to identify the effects of ambient temperature on survival rate, growth, body temperature and haematological values were undertaken 24 female and 12 male New Zealand White and California rabbits. It was concluded that rabbits should be grouped in same age, breed and sex lots to obtain optimum performance (Ongun & Poyraz 2002).

The inclusion of at least 25 % of Angora rabbit wool in a blend with cotton in knitted fabrics increased both comfort and thermal insulation properties (Oglakcioglu *et al.* 2000).

Use as an animal model

Rabbits have been used as animal models and for largely purely academic research on several occasions. They have been used for example to investigate the effect of extracorporeal shock wave treatment (ESWT) on bony union using volume analysis of the callus mass by computed tomography and histology (Bulut *et al.* 2006).

Standardized full-thickness mucosal wounds were created in two adult female New Zealand rabbits (Poor things!) to provide bleeding on both sides of the nasal septum with a 3-mm surgical punch. The wounds were treated with topical Ankaferd Blood Stopper on one side and with topical isotonic saline solution as a control on the other in order to stop bleeding. Duration of bleeding was measured to compare the haemostatic effect of Ankaferd Blood Stopper with saline solution. Mean bleeding time in the wounds administered Ankaferd Blood Stopper were 98 s and were significantly less than the 266 s of the controls. The study suggested that Ankaferd Blood Stopper may be more effective in reducing time to haemostasis than isotonic saline solution in this rabbit epistaxis model (Kurtaran *et al.* 2010).

One experiment studied the use of Ranibizumab (trade name Lucentis) – a drug commonly employed in humans for treatment of wet age-related macular degeneration – on the inhibition of corneal neovascularization (Ekinici *et al.* 2011). At least one study have investigated the effect of various sex hormones on bladder urodynamics (Celayir & Ilce 2005). A further one examined the effects of administration of bisphosphonates on bone healing (Tekin *et al.* 2008). The histomorphology of the oviduct has also been the subject of study (Ozen *et al.* 2010) as has the anatomy of the carotid body (Eken *et al.* 2008). Unilateral ovariectomy in pregnant New Zealand does affected the current pregnancy but had no effect on subsequent ones in terms of gestation length, birth weights and overall fertility (Caliskan *et al.* 2008, Ozalp *et al.* 2012).

A study was undertaken to determine immunohistochemically vimentin positive cells by using anti-vimentin primary antibody, to elucidate ultrastructurally the morphological properties of these cells and to examine the presence of villous M cells in *villi epithelia*. It was shown that the cup cells were similar to immature M cells associated with intraepithelial lymphocyte without an intraepithelial pocketing and also showed a vimentin positive immunoreaction within their cytoplasm but these cells were not villous M cells or enterocytes (Beyaz *et al.* 2010).

Some studies have been undertaken on rabbits not because of an interest in the animal per se but as an adjunct to an author's or group of authors interest in something else as is the case with studies of the *sacculus rotundus*, leucocytes and aflatoxins (Ozcan 2005, Besoluk *et al.* 2006, Sur *et al.* 2012).

Marketing and trade

There are no formal marketing channels for rabbit meat and the extent and amount of informal trading is not known. There have been sporadic imports of rabbit meat since the early 1990s. These amounted to 9 tonnes valued at US\$ 14 000 in 1993; 21 tonnes valued at US\$ 26 000 in 1997 and small amounts not assigned any quantity (but probably less than 1 tonne) in 1996 and 2008 (FAO 1994-2009).

There was no local production of Angora rabbit fibre prior to 1995. In that year (1995), 105 tonnes of Angora rabbit fibre was imported (Kocak & Taskin 2004). There are no data on other imports, exports or local trade.

There is little to no sale at retail outlets of rabbit meat due to the current prohibition of its consumption by followers of Alevi-Bektashi. There are clear religious and possibly political undertones in this prohibition. It can be concluded that the imports referred to are for specialist consumption and very probably in the tourist areas.

Pathology

Prevalence rates varying from 13.3 to 80 % of *Eimeria* infections have been reported from various regions of Turkey (Merdivenci 1963, Tasan & Ozer 1989, Cetindag & Biyikoglu 1997, Karaer 2001). In a recent study highly pathogenic *Eimeria intestinalis* and mildly pathogenic *E. perforans* and *E. coeicola* were found in the intestines of ten young dead rabbits from a commercial farm: oocyst counts were in the range 15 000-17 500 per g of faeces (Oncel *et al.* 2011). It is probable that coccidiosis is one of the major hazards to profitable rabbit production in Turkey due to unsanitary conditions and lack of knowledge on the part of owners.

Sarcoptic mange caused by the mite *Sarcoptes scabiei* is also a major health problem in Turkish rabbits (Voyvoda *et al.* 2005, Kaya *et al.* 2010). Due to the nature of the problem the cure is somewhat complicated and involves multiple injections of broad spectrum antiparasite drugs. Treatment with moxidectin achieved only partial cures with doramectin achieving better results but ivermectin appears to be better than both of these with complete cure being reached in 28 days.

Several species of blowfly cause myiasis in many species of domestic animals. The first

reported case of myiasis in a rabbit in Turkey was caused by the larvae of the »greenbottle« *Lucilia sericata* and it appears that this is the main species for this trauma in all domestic species (and humans) in the country (Ipek & Ipek 2012).

Postmortem examinations (102 domestic and 8 wild) and faecal egg counts (502 animals) were carried out to determine the presence of digestive tract and respiratory system helminths in rabbits in Ankara Province. *Passalurus ambiguus*, *Nematodirus leporis*, *Trichostrongylus retortaeformis*, *Trichuris sp.* and *Dicrocoelium dendriticum* were found at postmortem and eggs of *Strongyloides sp.* and *P. ambiguus* were identified in faecal samples (Gurler & Doganay 2007).

Two New Zealand rabbits from a commercial farm suddenly developed clinical signs including torticollis and limb asthenia. The cause was eventually diagnosed as infection by *Encephalitozoon cuniculi*, a protozoan parasite that – in spite of its specific name – naturally infects several host species and notably including humans. In view of the potential zoonotic risk, contact with the urine of infected or healthy animals should be avoided and good personal hygiene should be ensured when handling animals (Ozkan *et al.* 2011).

Constraints, opportunities and conclusions

Rabbit production in Turkey faces many constraints. The principal among these are:

- high quality stock is difficult to obtain or not available;
- there is no production of specialized feed and there are no standard feeding methods;
- suitable housing and equipment (cages, feeders, drinkers, slaughtering and processing machinery) are not available in the country;
- rabbit production is usually a small sideline and producers have no training or experience of husbandry;
- there are no formal marketing channels for meat nor for fibre;
- the world trade in Angora fibre is dominated by a few countries (China, Argentina, France) and importers demand quality that Turkey is unlikely to be able to supply;
- public sector support (extension advice on management, feed and health) is minimal, there has been little production research and there is no established producer organization; and
- eating of rabbit meat is not widespread due to religious and cultural restrictions.

The opportunities for expansion of rabbit production derive in large part from the constraints and are:

- provide a source of high quality (genetic worth) stock;
- train local entrepreneurs in production of suitable equipment;
- undertake relevant adaptive research on fibre and meat rabbits and make results available to producers and potential producers;
- arrange training and support for formation and operation of producer organizations;
- undertake campaigns to create awareness in consumers of the health benefits of rabbit meat (low fat/cholesterol); and
- support producers and processors in the development of niche markets for quality meat and fibre both at home and for export.

Rabbits have always been a minor component of Turkish livestock production. The species is effectively unknown in the public sector and no records of it are kept nor of its contribution or potential contribution to household incomes and human well-being in general. Social and religious pressure will continue to inhibit increased rabbit production for meat but there are no such impediments to production of fibre. Rabbit production would make it a useful aspect of diversification of risk and income for many small scale and resource poor farmers.

References

- Akar I, Canooglu E (2006) [Determination of Some Reproductive Parameters and Evaluation of Live Weights For Pregnancy Diagnosis in White New Zealand Rabbits]. *Erciyes Univ J Health Sci* 15, 20-25 [in Turkish]
- Akin Y, Testik A, Hacıoglu E (1996) [A comparison of various traits of some rabbit breeds and Spanish Live V genotype raised at the Ankara Poultry Research Institute]. *National Poultry Symposium 1996*, 126-134 [in Turkish]
- Akinci Z, Poyraz Ö, Akcapinar H, Evogliyan N (1998) [The Effects of Genotype, Sex and Age on Some Slaughter Traits and Carcass Characteristics of New Zealand White and California Rabbits]. *Lalahan Hay Arast Enst Derg* 38, 84-102 [in Turkish]
- Anon (2011) Domestic Animal Genetic Resources in Turkey. General Directorate of Agricultural Research and Policy, Ministry of Food Agriculture and Livestock, Ankara, Turkey
- Artukoglu MM, Isin S, Gencler F, Kocak C (2007) [General Characteristics of Angora Rabbit Raising in Turkey, Problems and Some Suggestions]. *Ege Üniv Ziraat Fak Derg* 44, 49-64 [in Turkish]
- Bekyürek T (1998) [Effect on fertility of fur plucking of Angoras]. In: *Proc 1st Symposium on Fur Animals*, 19-20 March 1998, Ankara University, 83-91 [in Turkish]
- Bekyürek T, Ün M, Demiral O (2005) The Influence of Shearing on Reproduction in Angora Rabbits. *Turk J of Vet Anim Sci* 29, 1239-1245
- Besuluk K, Eken E, Sur E (2006) A morphological and morphometrical study on the sacculus rotundus and ileum of the Angora rabbit. *Vet Med (Praha)* 51, 60-65
- Beyaz F, Ergün E, Ergün L, Bayraktaroglu AG (2010) [The structural properties of vimentin positive cells in the ileum epithelium of Angora rabbit]. *Ankara Üniv Vet Fak Derg* 57, 229-234 [in Turkish]
- Bulut O, Eroglu M, Ozturk H, Tezere G, Bulut S, Koptagel E (2006) Extracorporeal shock wave treatment for defective nonunion of the radius: a rabbit model. *J Orthop Surg Res* 14, 133-137
- Caliskan C, Ozalp RG, Ozyigit MO, Seyrek-Intas K (2008) Foetal mummification and necrotic metritis in a New Zealand white rabbit (*Oryctolagus cuniculus*). *Aust Vet Pract* 38, 9-12
- Celayir S, Ilce Z (2005) The Effects Of Different Sex Hormones On Female Rabbit Urodynamics: An Experimental Study. *Internet J Urology* (2) 2, doi: 10.5580/b33
- Cetindag M, Biyikoglu G (1997) [The spread of species of Eimeria in domestic rabbits raised in Ankara District]. *T Parasit Derg* 21, 301-304 [in Turkish]
- Demirel R, Fidan H (1999) [Economical and Biological Effects of Use of Urea Like Protein Source on Rabbit Races of White New Zealand, California and Chinchilla]. *Lalahan Hay Arast Enst Derg* 39, 73-83 [in Turkish]
- Eken E, Besuluk K, Dönmez HH, Boydak M (2008) A morphological study on the carotid body of the Angora rabbit. 2, 49-54
- Ekinci M, Yigit FU, Oba ME, Cagatay HH, Hüseyinoglu Ü, Yakan S, Arslan B (2011) Inhibition of Corneal Neovascularization by Ranibizumab (Lucentis): An Experimental Study in Rabbit Cornea. *Kafkas Univ Vet Fak Derg* 17, 853-857
- Ergun P (2011) [On the mythological roots of rabbit belief in Alevi Bektashi Culture]. *Turkish Culture and Hacı*

- Bektas Veli Research Quarterly 60, 281-312 [in Turkish]
- FAO (1994-2008) Production Yearbooks. Food and Agriculture Organization, Rome, Italy
- GDAR = General Directorate of Agricultural Research (2004) Turkey Country Report on Farm Animal Genetic Resources. Ministry of Agriculture and Rural Affairs, Ankara, Turkey
- Gürler AT, Doganay A (2007) [Helminths of digestive and respiratory system of rabbits in Ankara and districts]. Ankara Üniv Vet Fak Derg 54, 105-109 [in Turkish]
- Ipek DNS, Ipek P (2012) A case of Traumatic Myiasis in a Domestic Rabbit (*Oryctolagus cuniculus*) Caused By *Lucilia sericata*. Türkiye Parazit Derg 36, 54-56
- Karaer Z (2001) [Coccidiosis in domestic rabbits (*Oryctolagus cuniculus*)]. In: Dincer S (ed.) Coccidiosis. Metadana Printing House, Izmir, Turkey, 269-278 [in Turkish]
- Kaya D, Inceboz T, Kolatan E, Güneli E, Yilmaz O (2010) Comparison of efficacy of ivermectin and doramectin against mange mite (*Sarcoptes scabiei*) in naturally infested rabbits in Turkey. Vet Ital 46, 51-56
- Kocak C, Taskin T (2004) [Angora rabbit handbook. Publication No 1]. Turkish Animal Science Association, Izmir, Turkey [in Turkish]
- Kurtaran H, Ark N, Ugur KS, Sert H, Ozboduroglu AA, Kosar A, Gunduz M (2010) Effects of a Topical Hemostatic Agent on an Epistaxis Model in Rabbits. Curr Ther Res 71, 105-110
- Merdivenci A (1963) [Eimeria infections in domestic and wild rabbits in Turkey]. Turk Bioloji Derg 13, 26-35 [in Turkish]
- Oglakcioglu N, Celik P, Ute TB, Marmarali A, Kadoglu H (2009) Thermal comfort properties of Angora rabbit/cotton fiber blended knitted fabrics. Textile Res J 79, 888-894
- Oncel O, Gulegen E, Senlik B, Bakirci S (2011) Intestinal Coccidiosis in Angora Rabbits (*Oryctolagus cuniculus*) Caused by *Eimeria intestinalis*, *Eimeria perforans* and *Eimeria coecicola*. Yuzuncu Yil Univ Vet Fak Derg 22, 27-32
- Ongun SN, Poyraz Ö (2002) [The effects of ambient temperature on survival rate, growth, body temperature and hematological values of rabbits (*Oryctolagus cuniculus*)]. Turk Hij Den Biyol Derg 59, 25-42 [in Turkish]
- Ossard H, Thébault RG, Vrillon JL, Allain D, de Rochambeau H (1995) Economic overview of the French and world markets for Angora rabbit wool. European Fine Fibre Network, Occasional Publication No. 5, 35-47
- Ozalp GR, Ozocak-Batmaz E, Simsek D, Seyrek-Intas K (2012) Maintenance of pregnancy and evaluation of subsequent fertility in unilaterally ovariectomized rabbits. Vet Res 5, 1-3
- Özcan Z (2005) Determination of Alpha Naphthyl Acetate Esterase Activity in the Peripheral Blood Leukocytes in Angora Rabbits. Turk J Vet Anim Sci 29, 881-884
- Özen A, Ergün E, Kürüm A (2010) Histomorphology of the oviduct epithelium in the Angora rabbit. Turk J Vet Anim Sci 34, 219-226
- Ozkan O, Ozkan AT, Zafer K, (2011) Encephalitozoonosis in New Zealand rabbits and potential transmission risk. Vet Parasitol 179, 234-237
- Perincek S, Bahtiyari MI, Körlü AE, Duran K (2008) Ozone treatment of Angora rabbit fiber. J Cleaner Prod 16, 1900-1906
- Powis G, Kooistra KL (1987) Doxorubicin-induced hair loss in the Angora rabbit: a study of treatments to protect against the hair loss. Canc Chemother Pharmacol 20, 291-296
- Sur E, Dönmez HH, Boydak M, Ataman MB (2012) Effects of Glucmannan on the Sacculus Rotundus and Peripheral Blood Lymphocytes in New Zealand Rabbits during Aflatoxicosis. Sci World J, Article ID 632945 doi: 10.1100/2012/632945
- Tasan E, Ozer E (1989) A study of *Eimeria* (Protozoa, Eimeridae) in wild rabbits in remote parts of Elazığ and Tunceli. Doğa Türk Vet Hayv Derg 13, 60-65
- Tekin U, Tüz HH, Önder E, Özkaynak Ö, Korkusuz P (2008) Effects of Alendronate on Rate of Distraction in Rabbit Mandibles. J Oral Maxillofac Surg 66, 2042-2049
- Testik A (1996) The situation of rabbit production and production performances of some exotic rabbits in

- Turkey. In: Proc 6th World Rabbit Congress, 9-12 July 1996, Toulouse, France, 3, 435-436
- Testik A, Baselga M, Yavuz C, Garcia ML (1999) Growth performances of California and line V rabbits reared in Turkey. *Cahiers Options Méditerranéennes* 41, 159-162
- Voyvoda H, Ulutas B, Eren H, Karagenc T, Bayramli G (2005) Use of doramectin for treatment of sarcoptic mange in five Angora rabbits. *Vet Dermatol* 16, 285-288
- Yildirim O, Kul S, Seker I (2005) [Angora rabbit. I. Some production traits]. *Dogu Anadolu Bolgesi Arastirmalari* 112-116 [in Turkish]
- Yilmaz O, Wilson RT (2012) The domestic livestock resources of Turkey: Economic and social role, species and breeds, conservation measures and policy issues. *Livest Res Rural Dev* 24, Article 157