



## RESEARCH ARTICLE

### Seroprevalence and economic significance of hypodermosis in cattle in Diyarbakır province

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#### Öz

**Sayin Ipek DN, Diker AI.** Diyarbakır ilinde sığırlarda hypodermosisin seroprevalansı ve ekonomik önemi.

#### Abstract

**Sayin Ipek DN, Diker AI.** Seroprevalence and economic significance of hypodermosis in cattle in Diyarbakır province.

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**Amaç:** Bu çalışma Türkiye'nin güneydoğu bölgesinde yer alan Diyarbakır ilinde sığır hypodermosis'in seroprevalansını ve neden olduğu ekonomik kaybı ortaya koymak için yürütülmüştür.

**Aim:** The aim of present study was to investigate the seroprevalence and economic significance of hypodermosis in cattles in the Diyarbakır province located in the southeast part of Turkey.

**Gereç ve Yöntem:** Çalışmanın yapıldığı Kasım 2012 and Ekim 2013 tarihleri arasında Diyarbakır ilinde toplam 650 sığırdan serum örneği toplandı.

**Materials and Methods:** Serum samples were collected from 650 randomly selected cattle in Diyarbakır province between November 2012 and October 2013.

**Bulgular:** İncelenen toplam 650 serum örneğinden 236 (%36.6)'sında hypoderma antikorları için seropozitiflik tespit edildi. Çalışmada en yüksek seropozitiflik il merkezinde (%45.5) tespit edilirken, dişilerde (%37) belirlenen seropozitiflik erkeklerden (%33.3) daha yüksek oranda belirlendi. En yüksek seropozitiflik beş yaş üzeri (%41.6) hayvanlarda tespit edilirken, yerli ırklarda (%48.8) belirlenen seropozitiflik oranı diğer ırklardan daha yüksek olarak tespit edildi. Hastalığın deride meydana getirdiği yıllık tahmini ekonomik kaybın 101.310 TL olduğu belirlendi.

**Results:** 236 (36.6%) out of 650 serum samples were seropositive for Hypoderma antibodies. It was shown that the highest detected seropositivity rate was in central distinct and that seropositivity rate was higher in females (37%) compared to the male animals (33.3%). Moreover, the seropositivity rates were higher in native (48.8%) compared to the other breeds and in animals older than 5 years (41.6%) compared to younger animals. The estimated economic loss due to the damaged hides was 101.310 Turkish Lira per year (47.563 United States Dollars).

**Öneri:** Hypodermosisin bu bölgede çok yaygın olduğu ve dericilik sektöründe önemli kayıplara neden olabileceği ifade edilebilir.

**Conclusion:** It may be stated that hypodermosis is widespread in the region and it causes substantial economic loss in the hides sector.

**Anahtar kelimeler:** Hypoderma, seroprevalans, ekonomik kayıp

**Keywords:** Hypoderma, seroprevalence, economic losses





## Introduction

Bovine hypodermosis is a subcutaneous myiasis caused by the larvae of *Hypoderma bovis* and *Hypoderma lineatum*. It is characterized by the presence of subcutaneous warbles in dorsal and lumbar region and widely spread in the northern hemisphere. It causes significant losses in the countries' economies due to the hide damage as well as reduction in meat and milk yields (Zumpt 1965, Colwell 1992, Boulard 2002).

After mature females attach their eggs on the hairs of cattle, the development of the larvae on the hosts endures approximately one year. The climatic variations influenced the period of emergence of adult fly from pupal stage have been reported in the different geographical areas of the world (Zumpt 1965, Navarrette et al 1993, Reina et al 1995).

Bovine hypodermosis is common in 55 countries and its reported prevalence in Turkey are 31.9% in Kars, 26.3% in Elazığ, 22.3% in Malatya, 38.6% in Şanlıurfa, 5.3% in Afyonkarahisar, 28.6% in Erzurum, 3.56% in Thracian, 5.08% in Niğde and 35.8% in Van. (Taşçı et al 1994, Kara et al 2005, Ozkutlu and Sevgili 2005, Karatepe and Karatepe 2008, Simsek et al 2008, Balkaya et al 2010, Sayin et al 2010, Cicek et al 2011).

The researchers usually lean on their findings on the palpation and slaughterhouse examination (Gulanber et al 2000, Sayin et al 2000, Kara et al 2005). During the last years, immunological methods for the detection of cattle hypodermosis have been developed as an alternative to clinical parasitological examination and postmortem examination.

Enzyme-linked immunosorbent assay (ELISA) methods for this myiasis allows easy and cost-effective diagnosis on living animals (even when larvae are still migrating); it thus permits planning of timely treatment when larvae have not yet caused economic losses, and monitoring of eradication programs in broad area (Otranto 2001).

The reported economic losses per year caused by hypodermosis are 22.8 million United States Dollars (\$) in Pakistan (Drummond 1981), \$ 192-600 million in the United States of America and \$ 14 million in Canada (Kelin 1980; Khan 1977), 100 million shillings in Austria (Kutzer 1984), £ 13 million in United Kingdom (Colwell 1992), 119 million lire (\$ 42 million) in Greece and \$ 11.5 million in Italy (Macchioni 1984), Rs. 22.8 million in Punjab (Pakistan) (Khan 2006). In a study conducted in Turkey, the reported estimated economic loss was \$ 8141 year in Afyonkarahisar (Cicek et al 2011).

The objective of this study is to search the seroprevalence and economic significance hypodermosis of cattle in Diyarbakır.

## Materials and Methods

### Study period and area

The study was carried out in Diyarbakır province, located in south-eastern Anatolia, between November 2012 and October 2013. The province is located at an altitude of 670 m and its geographical coordinates are 37 °55' N longitude and 40 °14' E latitude. This city is warm and dry in summers and cool in winters. Annual average precipitation is 496 mm, average temperature is 15.8 °C and average humidity is 55% in Diyarbakır. This study was approved by the Department of Experimental Animals Ethic Committee, University of Dicle (No:2011/19).

### Serum samples

Serum samples were collected from 650 randomly selected cattle in villages of central and five districts. Blood samples were taken from the jugular vein in cattle, put into gel tube and transferred to laboratory, where they centrifuged and stored at -20°C until analyzed. Breed characteristics, age and sex were enrolled.

### ELISA analysis

The study utilized ELISA Test Kit (IDEXX Bovine Hypodermosis Antibody Test Kit (serum). It was performed according to the manufacturer's instructions. The values obtained through reading the microtiter plates at a wavelength of 450 nm using the ELISA microplate reader (Thermo Multiscan Go) was then calculated by the equation specified in the kit's procedures:

$$OD\% = 100 \times \frac{\text{Samples OD} - \text{Negative controls OD}}{\text{Positive control OD} - \text{Negative controls OD}}$$

Test sample's percentage value of  $\geq 55\%$ , were considered positive and results of  $\leq 45\%$  were considered to be negative.

### Economic losses

The number of slaughtered animals in the slaughterhouses of the central districts and Ergani was obtained from Directorate of Provincial Food Agriculture and Livestock. Four districts involved in the study did not have a slaughterhouse, so slaughtering of the animals were detected to be performed in the districts with slaughterhouses.

Therefore, the economic losses were estimated based on the total slaughtered cattle with hypodermosis in Ergani and central district. Estimated infested animal numbers were calculated from total seroprevalence rate of the disease. The prices of the hides with and without warbles were obtained



from randomly chosen 12 leather-merchants and the average price was calculated. The price differences of the hides with and without warbles were determined and the estimated total economic loss was calculated according to methods reported by Khan et al. (2006)

#### Data analysis

Statistical analysis was used by SPSS 15.0 software for Windows. Pearson's chi-square test was performed to evaluate the differences in the breed characteristics, age and sex.

### Results

#### Serological findings

The results of serological study are summarized in Table 1. 236 (36.6%) out of 650 cattle were seropositive for hypodermatitis antibodies. Among the study fields, the highest seropositivity rate was detected in the central district (45.5%) and Bismil (45%).

However, the lowest seropositivity rate was in Çınar (27.7%). In districts where the highest data was obtained, the average number of cattle per farm was found to be 8.36 in central and 7.73 in Bismil district.

In Çınar district that has the lowest rate of seropositivity, the average number of cattle per farm was found to be 21.10 (Table 2). The percentage of seropositivity in females was higher (37%) than the males (33.3%), the difference was not statistically important ( $P>0.05$ ). The seropositivity was

31.9% in crossbred cattle, 35.5% in purebred cattle and 48.8% in native. Although there was no statistical difference between crossbred and purebred cattle, the difference between native and crossbred and purebred cattle was significant ( $P<0.05$ ).

### Discussion

Bovine hypodermosis that is endemic in the northern hemisphere, is a parasitic disease with economic importance. The hypodermosis is diagnosed in live animals by the observation of the warbles in the back region and various serological methods.

While direct clinical investigation methods are only applicable in a 3-4 months period that show changes according to the seasonal conditions influencing the larvae localization in the subcutaneous tissues, serological methods enable early diagnosis. (Boulard 1975, Webster et al 1997, Otranto 2001) Our study was carried out by using commercial ELISA kits to analyse specific antibodies for hypodermatitis in the cattle sera collected between November 2012 and October 2013.

Bovine hypodermosis is a widely seen cattle disease in Turkey. The studies have shown that the rate is between 5.03% and 38.6% in our country. In the majority of the studies, it was reported that the prevalence was determined in the examinations during the screening of the slaughterhouses and fields. In the world, the survey of hypodermosis in cattle have been used by serological methods, for example prevalence of hypodermosis reported 51.8% in China and 38.6-41.3% in Albania using ELISA (Marquardt et al 2000, Guan et al 2005).

Table 1. Seroprevalence of bovine hypodermosis in six different district of Diyarbakır.

	Bismil			Çınar			Ergani			Karacadağ			Central			Silvan			Total		
	Ex (n)	Inf. (n)	Prev. %	Ex. (n)	Inf. (n)	Prev. %	Ex. (n)	Inf. (n)	Prev. %	Ex. (n)	Inf. (n)	Prev. %	Ex. (n)	Inf. (n)	Prev. %	Ex. (n)	Inf. (n)	Prev. %	Ex. (n)	Inf. (n)	Prev. %
Sex																					
Female	92	40	43.4 <sup>a</sup>	73	17	23.2 <sup>a</sup>	108	39	36.1 <sup>a</sup>	85	33	38.8 <sup>a</sup>	71	31	43.6 <sup>a</sup>	81	29	35.8 <sup>a</sup>	510	189	37.0 <sup>a</sup>
Male	8	5	62.5 <sup>a</sup>	17	8	47.0 <sup>b</sup>	38	7	18.4 <sup>b</sup>	12	3	25.0 <sup>a</sup>	41	20	48.7 <sup>a</sup>	24	4	16.6 <sup>a</sup>	140	47	33.5 <sup>a</sup>
Age																					
≤2	90	39	43.3 <sup>a</sup>	33	14	42.4 <sup>a</sup>	56	15	26.7 <sup>a</sup>	34	7	20.5 <sup>a</sup>	50	25	50.0 <sup>a</sup>	42	12	28.5 <sup>a</sup>	305	112	36.7 <sup>a</sup>
3-4	7	4	57.1 <sup>a</sup>	35	6	17.1 <sup>a</sup>	58	14	24.1 <sup>a</sup>	41	15	36.5 <sup>a</sup>	38	18	47.3 <sup>a</sup>	41	15	36.5 <sup>a</sup>	220	72	32.7 <sup>a</sup>
≥5	3	2	66.6 <sup>a</sup>	22	5	22.7 <sup>a</sup>	32	17	53.1 <sup>b</sup>	22	14	63.6 <sup>b</sup>	24	8	33.3 <sup>a</sup>	22	6	27.2 <sup>a</sup>	125	52	41.6 <sup>a</sup>
Breed																					
Crossbreed	20	11	55.0 <sup>a</sup>	61	11	18.0 <sup>a</sup>	87	21	24.1 <sup>a</sup>	19	3	15.7 <sup>a</sup>	92	39	42.3 <sup>a</sup>	53	21	39.6 <sup>a</sup>	332	106	31.9 <sup>a</sup>
Purebreed	76	32	42.1 <sup>a</sup>	9	2	22.2 <sup>ab</sup>	48	18	37.5 <sup>ab</sup>	2	2	100.0 <sup>a</sup>	12	7	58.3 <sup>a</sup>	40	5	12.5 <sup>b</sup>	187	66	35.2 <sup>a</sup>
Native	4	2	50.0 <sup>a</sup>	20	12	61.1 <sup>b</sup>	11	7	63.6 <sup>b</sup>	76	31	40.75 <sup>a</sup>	8	5	62.2 <sup>a</sup>	12	7	58.3 <sup>a</sup>	131	64	48.8 <sup>b</sup>
Total	100	45	45	90	25	27.7	146	46	31.5	97	36	37.1	112	51	45.5	105	33	31.4	650	236	36.3

Ex: Examined, Inf: Infected, Prev: Prevalence. Values with the different letters within the same column are significantly different ( $P<0.05$ )





Table 2. Number of farm, total cattle and cattle per farm in districts.

District	No. of farm	No. of cattle			No. of total cattle	No. of cattle per farm
		Crossbreed	Purebreed	Native		
Bismil	2500	15934	1157	2243	19334	7.73
Çınar	2014	13540	7750	21210	42500	21.10
Ergani	5970	20300	15230	19597	55127	9.23
Karacadağ	1523	940	120	14140	15200	9.98
Central	5294	14603	18567	11094	44264	8.36
Silvan	3135	6730	33670	4497	44897	14.32

In Turkey, there are limited serological surveys notified on bovine hypodermosis (Ozkutlu and Sevgili 2005, Simsek et al 2008, Balkaya et al 2010).

Ozkutlu and Sevgili (2005) reported that the seropositivity in Sanliurfa was 38.6% and the seropositivity rate in purebreed and crossbreed animals is statistically important. Simsek et al (2008) conducted a study in the southeastern part of Turkey and informed that the seropositivity was 23.3 % and the rate in females (31%) was higher than the males (14.1%). In same study the reported seropositivity was 27.7% in native, 26.6 % in crossbreed animals and 19.7 % in purebreed animals. Balkaya et al. (2010) reported that the seropositivity was 28.6% in Erzurum and all seropositive animals were female and native.

Our study showed that 236 (36.6%) out of 650 cattle were seropositive regarding the hypoderma antibodies. The overall seropositivity rate obtained in our study was higher than the study reported by Simsek et al (2008) and Balkaya et al (2010), but it was very close to the seropositivity rate reported for Şanlıurfa (Ozkutlu and Sevgili 2005).

This difference may be explained by the seasonal conditions. Şanlıurfa and Diyarbakır are low altitude cities with relatively hotter summers and milder winters compared to the cities with lower seropositivity rates. We believe that the seasonal conditions in these cities have a positive effect on the fly population. In our study, there was no significant difference between the sex and ages ( $P>0.05$ ). Similar to the studies conducted by Simsek et al (2008) and Balkaya et al (2010), in our study, the highest seropositivity rate was in native breeds

(48.8 %) and the difference between the native breeds and purebred/crossbred animals was statistically significant ( $P<0.05$ ).

When the seropositivity rates in the studied districts were investigated, Çınar that has the highest average cattle number per farm, has the lowest seropositivity rate and the central district that has the lowest average cattle number per farm, has the highest seropositivity rate. Generally, husbandry in Diyarbakır province and its districts is performed for subsistence economy. For this reason, their average cattle numbers per farm are low.

However, husbandry started to industrialize recently. In addition, average cattle per management in regions that has started to industrialize is observed to increase. We believe that, since the animal management, veterinary practitioner controls and protective medicinal applications are performed regular, the risk of enfestation for hypodermosis is lower in modern and integrated systems.

Bovine hypodermosis is a disease causing a decline in meat and milk production and increase the sensitivity to the infections because of the suppression of the immune system. Additionally it causes a significant economic loss as a consequence of the damage to the hides (Tarry 1986, Macchioni 1984, Colwell 1992). Turkey has an important place in the world regarding the hide production and 3.430.723 cattle hides were produced during our study period. The yearly economic loss on hide is estimated to be 101.310 TL (47.563 USD) in Diyarbakır. There is only limited number of studies reporting on the economic loss due to the hypodermosis in

Table 3. Estimation of economic losses in cattle of Diyarbakır province during the year 2012-2013.

District	No. of total animal	Estimated infested no. of hides*	Unit price (TL)		Loss estimate (TL)	
			Warble-free hide	Warbled hide	Loss per hide	Total loss
Diyarbakır	25334	9210	55	44	11	101.310

\*Estimated infested hides were number of hides estimated from prevalence percentage of the hypodermosis and the number of animals seropositive for hypoderma antibody annually in study area. Currency Exchange rate is 1 United States Dollar: 2.130 Turkish Lira (TL)



the hides sector. Cicek et al (2011) reported that estimated economic loss was 18.880 TL/year in Afayonkarahisar. Our results are significantly higher than these results.

### Conclusions

As a results of this study demonstrated that hypodermosis is widespread in the region and seems that it causes substantial economic loss in the hides sector. Moreover, the losses have been estimated only on the basis of derating of hides in this study, which may be expected to be much higher if other aspects of the disease are also considered. For this reason, hypodermosis should be avoided by eradication or prevention / control programs planned to implement in the region.

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### References

- Animal Husbandry. Directorate of Provincial Food Agriculture and Livestock Web Sites Available at: <http://diyarbakir.tarim.gov.tr/> Accessed September 12, 2015.
- Balkaya I, Simsek S, Saki CE, 2010. A serological and molecular survey of cattle hypodermosis in east-Turkey. *Vet Parasitol*, 173, 287-91.
- Boulard C, 1975. Evolution des anticorps circulants chez les bovins traites centrel hypoderme. *Ann Vet Res*, 6, 143-151.
- Boulard C, 2002. Durably controlling bovine hypodermosis. *Vet Res*, 33, 455-464.
- Boulard C, Villejoubert C, Moire N, Losson B, Lonneux JF, 1996. Sero-surveillance of hypodermosis in a herd under therapeutic control. Effect of a low level of infestation. *Vet Parasitol*, 66,109-117.
- Cicek H, Cicek H, Eser H, Tandoğan M, Sarımehmetoğlu HO, 2011. Prevalence and economic significance of bovine hypodermosis in Afyonkarahisar province of Turkey. *Trop Anim Health Prod*, 43, 17-20.
- Colwell DD, 1992. *Cattle Grubs Biology and Control*. Publ. no. 1880/E. Communications Branch, Agri, Ottawa, Ontario, Canada, pp: 6-17.
- Drummond RO, Lambert G, Smalley HE, Terrill CE 1981: Estimated losses of livestock to pests. *CRC Handbook of Pest Management in Agriculture*, Vol. 1. CRC Press Inc., Boca Raton, Florida, USA, pp: 111-127.
- Guan G, Luo J, Ma M, Yang D, Wang Y, Gao J, Sun H, Liu Z, Liu A, Dang Z, 2005. Sero-epidemiological surveillance of hypodermosis in yaks and cattle in north China by ELISA. *Vet Parasitol*, 129,133-137
- Gulanber A, Tuzer E, Gargili A, Toparlak M, Efil I, Keles V, Ulu-tas M, 2000. A survey of hypodermosis in cattle slaughtered in Thrace (Trakya) Turkey. *Tr J Vet Anim Sci*, 24, 429-430.
- Kara M, Arslan MO, Gicik Y, 2005. The prevalence of bovine hypodermosis in Kars province, Turkey. *Trop Anim Health Prod*, 37, 617-622.
- Karatepe M, Karatepe B, 2008. Hypodermosis in cattle slaughtered in Nigde province, Turkey. *Trop Anim Health Prod*, 40, 383-386.
- Kelin KK, 1980. The economics of warble fly control. *Can Farm Econ*, 4, 20-27.
- Khan MA, 1977. Eradication of hypodermosis. *Vet Parasitol*, 3, 205-209.
- Khan MN, Iqbal Z, Sajid MS, Anwar M, Needham GR, Hassan M, 2006. Bovine hypodermosis: Prevalence and economic significance in southern Punjab, Pakistan. *Vet Parasitol*, 141, 386-390.
- Kutzer E, 1984. Present situation of hypodermosis in Austria. In: *Warble Fly Control in Europe. Proceedings of a Symposium in the EC Programme of Coordination of Research on Animal Pathology*, Brussels, Belgium, pp: 59-64
- Macchioni G, 1984. Economic aspects of control of bovine hypodermosis in Italy. *A symposium on warble fly control in Europe*, Brussels, Belgium pp:16-17
- Marquardt WC, Demaree RS, Grieve RB, 2000. *Parasitology and vector biology*. 2nd edition, Harcourt Academic Press, London, UK, pp: 628-633.
- Navarrete I, Reina D, Hernadez-Rodriguez S, Martinez-Moreno FJ, Galeano C, 1993. Preliminary studies on bovine hypodermosis in the province of Caceres (Spain). *Proc. of symposium on the control methods for warble fly in cattle and goats held in Sept. 16-18, Brussels, Brasi*, pp: 3-11.
- O'Brien DJ, 1998. Warble fly prevalence in Europe 1997 after Cost 811. In: Boulard, C., Sol, J., Pithan, K., O'Brien, D., Webster, K., Sampimon, O.C. (Eds.), *Improvements in the Control Methods for Warble Fly in Livestock*, Tours, France, June 5-7 1997 Cost 811, C.E.C. Luxembourg, pp: 20-33
- Otranto D, 2001. The immunology of myiasis: parasite survival and host defense strategies. *Trends Parasitol*, 17, 176-182.
- Ozkutlu Z, Sevgili M, 2005. Seroprevalence of hypodermosis in cattle in the province of Sanliurfa (Turkey). *Turkish J Parasitol*, 29, 275-279.
- Reina D, Martinez-Moreno FJ, Navarraete I, 1995. Studies with the rearing of cattle warble flies in Estremadura, Spain. In: *Improvements in control methods for warble flies in farms livestock*. Proc. XII European COST 811, Kinsale, Ireland, pp: 59-64
- Sayin F, Kalkan A, Karaer Z, 2000. Epidemiological studies on cattle hypodermosis in Turkey. *Firat Uni Med J Health Scien*, 14, 115-127.
- Simsek S, Utuk AE, Koroglu E, Dumanli N, 2008. Seroprevalence of hypodermosis in cattle in some provinces of Turkey. *Res Vet Sci*, 84, 246-249.
- Tarry DW, 1986. Progress in warble fly eradication. *Parasitol Today*, 2, 111-116.





Taşcı S, Değer S, Akgül Y, 1994. Van ve yöresinde hypodermosis. J Vet Medicine YYU, 5, 143-53.

Webster KA, Giles M, Dawson C, 1997. A competitive ELISA for the serodiagnosis of hypodermosis. Vet Parasitol, 68, 155-164.

Yin H, Ma M, Yuan G, Huang S, Liu Z, Luo J, Guan G, 2003. Hypodermosis in China. J Anim Vet Adv, 2, 179-183.

Zumt F, 1965, Myiasis in man and animals in the old world. Butterwoths, London, UK, pp. 267.