Kafkas Univ Vet Fak Derg
19 (1): 79-84, 2013
DOI: 10.9775/kvfd.2012.7227

Journal Home-Page: http://vetdergi.kafkas.edu.tr
Online Submission: http://vetdergikafkas.org

RESEARCH ARTICLE

Prevalence of Bovine Hypodermosis in Water Buffalo *(Bubalus bubalis)* from Jhelum District, Pakistan

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Makale Kodu (Article Code): KVFD-2012-7227

Summary

Hypodermosis is an endemic disease in semi-hilly and mountainous areas of Pakistan. Keeping in view the importance of buffaloes an epidemiological survey was conducted to determine the prevalence of hypodermosis in district Jhelum Punjab, Pakistan, during the year 2010-2011. Out of 1000 buffaloes examined clinically in the study area, 32 (3.2%) found to be positive for the warble fly infestation. The number of nodules in the infested animals ranged from 1-5 (2.7±1.1). There were significant differences ($P<0.05$) in the prevalence of *Hypoderma* spp. when the sex, age and different geographic areas were considered. The Prevalence was higher in males and young animals and also in those animals grazing in hilly and semi-hilly areas. The climatic conditions (temperature, humidity, sunshine and wind speed) favoured the warble fly activity and contributed in the onset of disease.

Keywords: *Hypodermosis, Prevalence, Water Buffalo, Jhelum, Pakistan*

Pakistan'ın Jhelum Bölgesindeki Su Mandalarında *(Bulbous bulbous)* Sığır Hypodermozis'inin Dağılımı

Özet

Hipodermozis Pakistanın dağlık ve tepelik bölgelerinde rastlanan endemik bir hastalıktır. Bu epidemiyolojik çalışma, Bufaloların önemi göz önünde bulundurularak, bu hayvanlarda hipodermozisin dağılımını ortaya koymak amacıyla 2010-2011 yıllarında Pakistan'ın Jhelum Punjab bölgesinde gerçekleştirilmiştir. Bu amaçla çalışma bölgesinde 1000'in üzerinde buffalo klinik olarak nokra sineği enfestasyonu yönünden kontrol edilmiş ve 32 (%3.2)'si pozitif bulunmuştur. Enfestasyon bulunan hayvanlardaki nodül sayısı 1-5 (2.7±1.1) arasında değişkenlik göstermiştir. Cinsiyet, yaş ve farklı coğrafik bölgeler yönünden değerlendirildiğinde Hypoderma dağılımında önemli farklılıklar belirlenmiştir. Hastalığın dağılımı erkek ve genç hayvanlarda ve aynı zamanda tepelik ve yarı-tepelik bölgelerde otlayan hayvanlarda daha yüksek bulunmuştur. İklimle ilgili faktörler (sıcaklık, nem, güneş, rüzgar hızı) nokra sineği aktivitesini artırmakta ve hastalığın başlamasında rol oynamaktadır.

Anahtar sözcükler: *Hipodermosis, Dağılım, Su Mandası, Jhelum, Pakistan*

INTRODUCTION

Pakistan is an agricultural country with semi arid landscape and subtropical climate. Most of the people earn their livelihood from selling agro-livestock products and rearing of livestock (cattle, sheep, goats and buffaloes). The productivity in the livestock sector is low due to several abiotic and biotic factors influencing productive potential of domesticated

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animals. One of these factors is the prevalence of parasitic infections, which plays a vital role in low livestock productivity.

Hypodermosis is a parasitic disease caused by a parasite commonly known as Warble Fly, belongs to genus *Hypoderma* (Diptera: Oestridae). Each species of this genus is strictly a parasite of a ruminant species. *H. diana* is specific to deer, *H. tarandi* to reindeer, *H. bovis* and *H. lineatum* to cattle, Buffalo [1].

Hypodermosis is widely distributed in all over the Northern hemisphere from Europe [2] to Eastern China [3]. The prevalence of hypodermosis was 41.9% in eastern region and 47.8% in southern region of Turkey [4]. Hypodermosis is a notorious and common disease of cattle, buffaloes and goats in Pakistan [5]. The prevalence of hypodermosis was 22-24% in cattle of different endemic areas due to the *Hypoderma* spp [6]. This myiasis is endemic in the semi-hilly, mountainous areas of the country [7]. The fly's egg laying season in different areas occurs from February-June. Warbles on the back of infested animals are generally recorded from November to January. Third instars (L_3) complete their development and fall to the ground by mid January.

Hypodermosis can be the cause of economic losses due to meat trim at slaughter, and the effect on hides is well established [8].The Prevalence of warble fly infestation has been 18.40% reported from four districts of Northern Punjab, Pakistan [9] and was 31.9% in kars province, Turkey [10]. The cattle and buffalo were equally exposed to hypodermosis [11]. The prevalence of hypodermosis in buffalo of Chakwal district was 5.20% [12].

Keeping in view the importance of buffaloes an epidemiological survey was conducted to find the prevalence of hypodermosis in different areas of district Jhelum (Pakistan). Individual factors (age, sex) affecting the infection by *Hypoderma* spp. in those hosts have been also studied.

MATERIAL and METHODS

Location and Sample Size

The present study was conducted in Jhelum district (32° 56'23"N 73°43'11"E) of Punjab, Pakistan *(Fig. 1)*. Jhelum is a city on the right bank of the Jhelum River, in the district of the same name in the north of Punjab province. The agriculture activities in the district Jhelum depends mainly on rainfall. The average rainfall of the area varies from 508-1.016 mm. The maximum mean temperature in summer (June to September) is recorded as 45.7°C (June), where in winter (October to February) the minimum temperature as recorded is 1.8°C (January). Average annual rainfall is about 900 mm [13].

From September 2010 to February 2011, a total of one thousand buffalo belonging to 16 herds from four different villages of Jhelum district were examined for the presence of hypodermosis. All the animals of Purana Metha, Deena Bypass, Hadali and Stadpur were examined on monthly basis. The prevalence was determined by the hand palpation method (by examining the nodules on all parts of body) *(Fig. 2)*.

Factors Considered in Risk Analysis

Sex and age of the animals were recorded. Three age groups were created: (1) including calves and yearlings (< 37 months), (2) integrated by sub-adults (37-72 months) and adults (> 72 months). In village Purana Metha, Hadali, Stad pur and Deena Bypass the number of examined female were 242, 235, 256 and 176, respectively. Similarly, the male were 40, 16, 13 and 22, respectively.

Since geographical variations could affect the development of pupae to adult, fly activity and the subsequent infection levels in the host population, the animals were also grouped by the village of precedence *(Table 1)*: Purana Metha, Hadali,

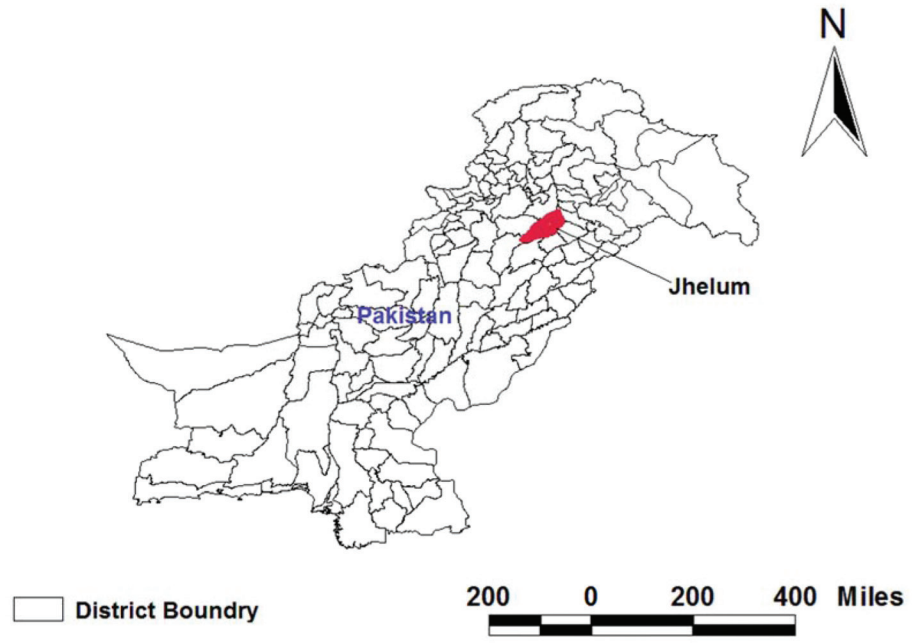

Fig 1. Map of Pakistan showing the location of the district Jehlum in the Northern Punjab, Pakistan

Şekil 1. Pakistanın kuzey Punjab (Jhelum) bölgesinin haritadaki yeri

Table 1. *Age and village wise prevalence of Hypodermosis in water buffalo in Northern Punjab (District Jhelum), Pakistan*
Tablo 1. *Pakistan'ın Kuzey Punjab (Jhelum) bölgesindeki su mandalarında Hipodermozisin yaşa ve köylere göre dağılımı*

Village	Age						Total No of Observed Animals	No of Infested Animals	Overall Prevalence (% age)
	<1-3		4-6		7-9<				
	Nº	Inf	Nº	Inf	Nº	Inf			
Purana Metha	55	17	23	6	204	-	282	23	8.15%
Hadali	50	2	14	7	187	-	251	9	3.58%
Stad por	36	-	18	-	215	-	269	0	0%
Deena Road (Bypas)	41	-	22	-	135	-	198	0	0%
Total	182	19	77	13	741	-	1000	32	3.2%

Nº *= Non Infested,* ***Inf*** *= Infested*

Fig 2. Nodules were detected by manual palpation
Şekil 2. Palpasyon ile tespit edilen nodüller

Fig 3. Warble on the back of a water buffalo from Northern Punjab, Pakistan
Şekil 3. Pakistanın kuzey Punjab bölgesindeki bir su mandasının sırt kısmında belirlenen nokra

Stad por and Deena Road (Bypas).

The information on the treatment procedure (Anti-parasitic) of animals against hypodermosis in the studied herds was determined in this study.

Statistical Analysis

The risk of being infected by *Hypoderma* larvae was evaluated with a data mining classification tree [14], taking into account the factors previously indicated. Particularly, an exhaustive Chi-squared automatic interaction detector (exhaustive CHAID) as described in Lopez [15] was applied. Buffaloes were classified as positive (larvae detected in palpation) or negative (no larvae detected) and CHAID algorithm identified variables that divide buffaloes in subgroups (tree nodes) with different positive/negative ratio. CHAID provided a way to identify major factors using as criteria the significance of a Chi-squared test and successively splitting data in increasingly homogeneous nodes in relation to dependent variable (larvae detection) until the classification tree was fully grown.

Statistical analyses were performed with statistical package SPSS for Windows 18.0 and SPSS answer Tree 3.1 (SPSS Inc., Chicago, IL USA).

RESULTS

Out of one thousand buffalo, 32 (3.2%; 95% CI 2.2-4.5) were found to be infested by *Hypoderma* spp. The number of nodules in the infested animals ranged from 1-5 (2.7±1.1). The nodules were observed on the back, hump and flank *(Fig. 3)*.

The warble started to appear by the end of September and skin perforation started from end of October to December. The larvae collected from infested buffaloes were identified as *Hypoderma lineatum* according to Zumpt [16]. This is the first report of *Hypoderma lineatum* in the buffalo of Jhelum district.

The CHAID analysis indicates that age was the most determining factor in hypodermosis prevalence *(Table 1; Fig. 4)*. The age of infested buffalo ranged from 1-6 years, whereas, 7-9 yr-old buffaloes were not infested in the present study. In the node 1, comprised by 1-6-yr-old buffaloes, village of precedence was detected as an influencing factor in hypodermosis prevalence. In Purana Metha village (node 3), 23 out of 81 buffaloes with less than 73 months of age were infested with hypodermosis (28.4% prevalence). In village Hadali, (node 4) nine were infested with hypodermosis (14.3%

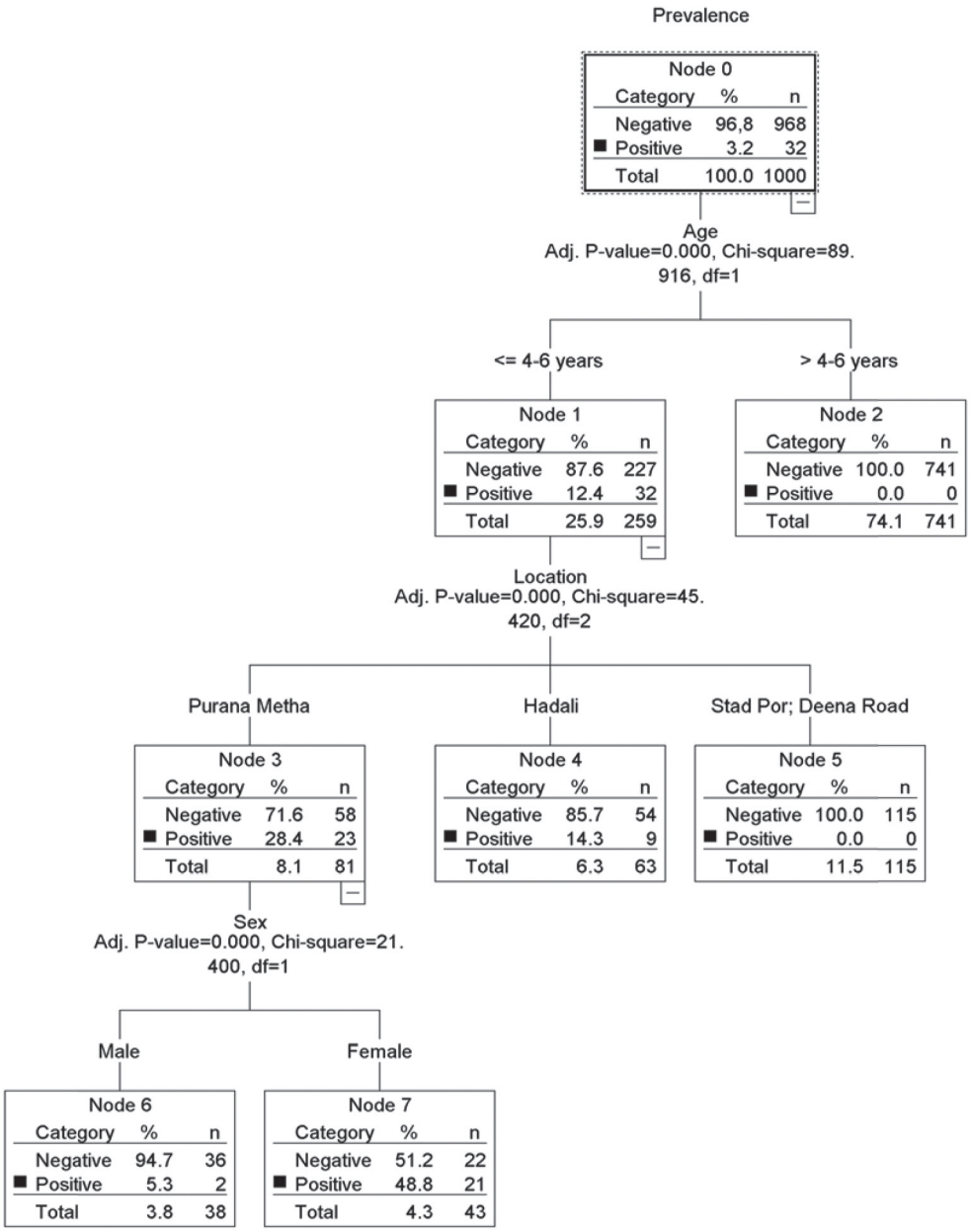

Fig 4. Statistical analysis

Şekil 4. İstatistiksel analizler

Prevalence in young buffalos). In village Stadpor and Deena Road (Bypass) no animals were infested by *Hypoderma* (Node 5). Finally, hypodermosis prevalence in buffaloes from Purana Metha buffaloes was influenced by sex. Female showed higher prevalence (48.8%, node 7) than male (5.3%, node 6).

In this study a total of sixteen herds were examined from different villages of district Jhelum and the WFI was only found in six herds *(Table 2)*.

In the present study, the 3.08% (28/881) female were infested with hypodermosis, while in male the prevalence was 4.39% (4/87), which shows higher prevalence in male than female *(Table 3)*.

Taramira oil *(Eruca sativa)* is commonly known as jamba oil. The oil is extracted from seeds. The taramera oil was used in non- infested buffalo herds on monthly basis as an anti-parasitic that might be very useful for control of hypodermosis in the study area. The opinion of these buffalo farmers is to use this oil as a local control. Ivermectin were also used in some herds along this local treatment.

DISCUSSION

In the present study the prevalence of hypodermosis in water buffalo from Northern Punjab was low (3.2%). A similar percentage (5.2%) of buffaloes was infested with hypodermosis from field in Chakwal [12]. However, the prevalence was much lower as eleven buffalo were infested out of thirty thousand examined buffalos from Dera Ghazi Khan [11], 10.04% in Jhelum district (Pakistan) [9], 31.9% in Kars province (Turkey) [10] and 41.9% in eastern Region (Turkey) [4].

Table 2. *Herd-level prevalence by Hypoderma in water buffalo from different villages of Northern Punjab (District Jehlum), Pakistan*
Tablo 2. *Pakistan'ın Kuzey Punjab (Jhelum) bölgesindeki su mandalarında Hypodermozisin farklı köylerde sürü bazındaki dağılımı*

Village	Grazing Pattern	Herd Name	No of Individual Examined/Herd	No of Individual Infested/Herd	Herd-level Prevalence (%)
Purana Metha	Field & Hilly	A	95	10	10.52%
		B	51	3	5.79%
		C	67	5	7.42%
		D	39	-	0%
		E	30	5	16.66%
Hadali	Field & Hilly	F	104	7	6.73%
		G	76	2	2.63%
		H	71	-	0%
Stad por	Non Hilly	I	121	-	0%
		J	47	-	0%
		K	24	-	0%
		L	77	-	0%
Deena Road(Bypas)	Non Hilly	M	51	-	0%
		N	36	-	0%
		O	89	-	0%
		P	22	-	0%
Total		**16**	**1000**	**32**	**3.2%**

Table 3. *Sex based prevalence by Hypoderma in Water Buffalo from different villages of Northern Punjab (District Jehlum), Pakistan*
Tablo 3. *Pakistan'ın Kuzey Punjab (Jhelum) bölgesindeki su mandalarında Hypodermozisin farklı köylerde cinsiyete göre dağılımı*

S. No	Village Name	Sex					
		Female			Male		
		Total No of Observed Animals	No of Infested Animals	Prevalence (%)	Total No of Observed Animals	No of Infested Animals	Prevalence (%)
1	Purana Metha	242	21	8.67%	40	2	5%
2	Hadali	235	7	2.97%	16	2	12.5%
3	Stadpur	256	0	0%	13	0	0%
4	Deena Bypass	176	0	0%	22	0	0%
Grand Total	**4**	**909**	**28**	**3.08%**	**91**	**4**	**4.39%**

The statistical analysis showed that there is a significant difference in the prevalence of hypodermosis between the different age groups, sex and village basis. The animals having age between 1-6 years were more infested with hypodermosis as compared to the animals having 7-9 age groups. While there is no difference age is found between the animals having 1-3 and 4-6 years age groups *(Fig. 4)*.

Those results agree with those of higher prevalence of WFI in young animals could be due to their softer skin, which facilitates the penetration of first instars of *Hypoderma* as reported earlier [17]. The prevalence of WFI was higher in the field young vs old animals in both the districts [18]. Intrinsic host determinants, however, may also contribute towards lower prevalence of WFI in older animals. It may be due to thicker skin of aged animals not allowing penetration of larvae, suppression of the developing larvae by internal regulatory systems of the host and development of resistance by continuous exposure of animals to larvae. Similar trends of age-wise prevalence of WFI have also been reported by Pruett and Kunz [19] and Papadopoulos [20].

When the village wise prevalence was considered, we found that the animals in village Purana Metha (8.15%) were significantly more infested followed by village Hadali (3.58%) as compared to all other two villages due to the suitable conditions. So in the present study the statistical analysis shows that there is a significant difference in the prevalence of buffalo hypodermosis in different villages of jhelum district. Similarly among all the villages, the village Purana Metha has more risks for hypodermosis due to the different biotic and abiotic factors (Hilly location) and animals grazing practices.

In the present study, the male animals were more infested with hypodermosis as compared to female due to the grazing practices and male were kept tied at home *(Table 3)*. Our results correlates as high prevalence due to the grazing pattern [21] as under grazing system are male were more proned to infestation, because they were kept tied [22]. Similarly, the prevalence of hypodermosis in male buffalo was higher then female [12]. The prevalence of hypodermosis was higher in male (26.50%) than in females (20.50 %) in Chakwal district, Pakistan [18].

The prevalence of WFI is higher in males then females due to the physiological differences between the two genders and the management practices in the area. The females are grazed in the study area and the males are kept tied. Hence, males are more prone to infestation than females which can run away from the attacking flies [7,22]. Herd-wise prevalence in the village Purana Metha is higher due to the suitable conditions (Temperature, Humidity, and Wind-speed) and grazing pattern.

It is concluded from the present study that the prevalence of hypodermosis is low, but in future it may increase and cause the economic losses in Pakistan. It has as important impact on animal health, behaviour, milk and leather industry. So it is very important to explore this disease in other agro-ecological areas of Pakistan. This study is very useful in determining the prevalence of hypodermosis in buffalo of Jhelum district, Pakistan.

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