EFFECT OF RADIATION ON VIABILITY AND INFECTIVITY OF NEMATODIRUS SP. EGGS

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Introduction

Nematodirus sp. are the parasites of ruminants and sited in small intestine. It's distribution is almost world wide but commoner in temperate regions. There are four species of nematodirus named N. filicollis, N. spathiger, N. battus, N. helvetianus. The first three species are commoner in sheep and goats and the last one is the species of cattle and is less commonly found in sheep, goat and camel. The adults of nematodirus sp. are slender worms about 2 cm. long. Nematodiriasis is an example of a parasitic disease where the principal pathogenic effect is attributable to the larval stages. Following ingestion of large numbers of infective larvae, there is disruption of the intestinal mucosa particularly in the ileum, although the majority of developing stages are found on the mucosal surface. Development through L4 to L5 is complete by 10-12 days from infection and this coincides with severe damage to the intestinal villi and erosion of the mucosa leading to villous atrophy. The ability of the intestine to exchange fluids and nutrients is grossly reduced and with the onset of diarrhoea the lamb rapidly becomes dehydrated. At necropsy the carcass has a dehydrated appearance and there is an enteritis in the ileum. In severe infections, diarrhoea is the most prominent clinical sign. As dehydration proceeds the affected animals become thirsty, inappetent and congregate round drinking places.

Nematodirus sp. infections are wide spread all over Turkey, especially young lambs are more affected by the parasites. Its prevalence in sheep and goats was studied by a number of workers and following figures have been reported; 32% in İstanbul, 67.4-91.3 % in Samsun, 41-78 % in Ankara (2, 3, 4, 5, 6).

Materials and Methods

In this study, effect of different levels of gamma irradiation on the hatching ability of *Nematodirus sp.* Eggs and infectivity of irradiated larvae in Angora goats were investigated. For this purpose, fresh faecal samples were collected from the villages of Ankara province. These samples were processed at the laboratory by floatation technique using saturated NaCl solutions and reasonably clean egg suspensions were obtained. Then, Nematodirus sp. eggs were picked up one by one from these suspensions under a stereo microscope. The

collected Nematodirus eggs had been incubated at 25°C until the larvae hatched. A total of 3000 larvae were administered to a goat and were placed in a metebolism cage to collect faeces. This monospesifically infected goat produced enough egg materials for irradiation studies. The collection and cleaning methods of faecal samples were as reported by Alabay et al. (1).

To study the effect of different levels of gamma irradiation on the hatching ability of Nematodirus sp. eggs; egg materials were exposed to radiation doses ranging from 1-300 Gy by a ^{137}Cs source of 10.000 Ci (Mark I-22 irradiator) with a dose rate of 1.81 kGy/h as determined by Fricke dosimetry. To study the infectivity of irradiated larvae; goats were into four groups. First three groups were given irradiated larvae and the forth one left as control given nonirradiated larvae. Irradiation doses were chosen according to vitality percentages of larvae. Those were 75 % (30 Gy), 50 % (50 Gy) and 25 % (100 Gy). Experimental animals including controls were infected with 500 Nematodirus larvae each. Animals were examined for infections by McMaster egg counting technique starting from day 16th. and necropsied on day 28th post infection. At the necropsy, small intestines were removed and examined for the presence of parasites.

Results and Discussion

It was found that there was not significant differences with respect to hacthing ability between the control and irradiated groups of eggs in low doses such as 1, 5, 10 and 20 Gy when larval development in eggs were examined. The results show that there is an inverse relationship between the gamma radiation dose used and the hatching ability of eggs after the dose of 30 Gy. The more the radiation dose level, the lesser the hatching was observed and there was no hatching of eggs after the dose of 225 Gy (Table 1). Moreover, degenerative changes in the developments and multiplications of blastomers relating to increases of radiation doses were observed. The differences between the control groups and the irradiated groups (starting from 30 Gy) were found to be statistically significant ($P< 0.05$). Twelve Angora goats were infected with each receiving 500 Nematodirus sp. larvae irradiated with doses of 0, 30, 50 and 100 Gy. All animals were sacrificed and worm counts were performed 28 days after infection. It was determined that there were decreases in the egg and worm counts and delayed egg sheddings with the increases of irradiation doses and no worms were obtained at a dose of 100 Gy. Also, the survival of more females than males in the collected parasites was found (Table 2). Although there are a number of reports on the effects of radiation on different parasite species, no studies were found on Nematodirus sp.

Table 1. Numbers of hatching larvae from irradiated eggs.

Irradiation Doses (Gy)	Numbers of larvae	%
Control	431	86.2
1	426	85.2
5	428	85.6
10	419	83.8
20	401	80.2
30	367	73.4
40	311	62.2
50	246	49.2
100	113	22.6
125	66	13.2
150	2	0.4
175	1	0.2
200	1	0.2
225	1	0.2
250	-	-
300	-	-

Table 2. Numbers of parasites recovered from goats.

Irradiation Doses (Gy)	Number of animals	Parasites		Total number of parasites
		Female	Male	
Control	1	113	96	209
	1	151	107	258
	1	78	63	141
30	1	12	5	17
	1	23	14	37
	1	42	17	59
50	1	-	-	-
	1	8	2	10
	1	-	-	-
100	1	-	-	-
	1	-	-	-
	1	-	-	-

References

1. Alabay.M., Çerçi,H., Aykol,F. (1985). An improved method of obtaining clean infective larvae of Trichostrongylus vitrinus. Doğa Bilim Derg., 9: 229-231.
2. Celep,A. (1987). Samsun yöresi kuzu ve toklularında paraziter fauna tesbiti ile kontrol ve tedavi gruplarında aylık ortalama ağırlık artışlarının belirlenmesine dair araştırmalar. Türk Vet. Hek. Dern. Derg., 57: 69-79.
3. Çetindağ,M., Bıyıkoğlu,G. (1997). İç Anadolu bölgesi tiftik keçilerinde mide barsak nematodlarının yayılışı. 10. Ulusal Parazitoloji Kongresi, Bildiri Özetleri, 2:79, Ankara, 8-12 Eylül.
4. Umur,T. (1991). Ankara yöresi tiftik keçilerinde sindirim sistemi helmintleri. Ankara Univ. Vet. Fak. Derg., 38: 322-338.
5. Vural,A., Onar,E., Özkoç,Ü., Everett,G. (1968). İstanbul iline bağlı köylerde koyunlarda gastrointestinal nematod, moniezia ve karaciğer trematodlarının yayılış durumu. Pendik Vet. Mikrobiyol. Derg., 1: 146-159.
6. Zeybek,H. (1980). Samsun yöresi koyun ve kuzularında paraziter fauna saptama çalışmaları. Ankara Univ. Vet. Fak. Derg., 27: 215-236.