Nematode parasite control practices of sheep and goat farmers in the region of Trikala, Greece

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Abstract

Information concerning worm control practices of sheep and goat farmers in the region of Trikala (central Greece) was collected through a questionnaire survey by visiting farms and interviewing farmers. Questionnaires from 57 farmers residing in 23 rural communities were collected. Anthelmintics were used by 89% of the farmers. On average, lambs, kids and goats were treated once annually, while sheep were treated either once or twice annually. Only 2% of farmers reported treatment of animals with anthelmintics when moving to new pastures. The most common broad-spectrum anthelmintics used were those belonging to the benzimidazoles and probenzimidazoles. Fifty nine percent of the farmers used the same anthelmintic group for 3 or more years and 34% used two or more anthelmintic groups in the same year. Almost all farmers reported estimating live weights for calculating anthelmintic doses through visual perception on the basis of an average weight (96%). Tablets and boluses were the most preferred anthelmintic formulation used by 96% of farmers. The selection of an anthelmintic was based for 58% of farmers on recommendation by a veterinarian and for 39% of farmers on the cost of the drug. The most common occasions for deworming the animals were at turn out (86%) and after parturition (31%). Only 6% of farmers reported deworming new animals before introducing them onto the farm. Farmers preferred to seek information about the use of anthelmintics and worm control strategies from veterinarians (63%) and other farmers (37%).

Introduction

The health and productivity of grazing sheep and goats rely on, among other factors, the use of some anthelmintics for nematode parasite control. Currently, the effectiveness of anthelmintics is under threat due to the development of anthelmintic resistance in sheep and goat nematodes. This phenomenon has become a significant practical problem in various regions of the world and has been reported recently in Greece (Papadopoulos *et al*., 1996). The appearance of anthelmintic resistance is attributed to incorrect nematode parasite control practices and the farmers' lack of knowledge about worm control strategies, anthelmintic use and the problem of anthelmintic resistance (Maingi *et al*., 1996a,b).

Information concerning worm control practices of sheep and goat farmers in Greece that may promote development of anthelmintic resistance is lacking. For this reason, a questionnaire survey was carried out on

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nematode parasite control practices and the profile characteristics of sheep and goat farmers in the region of Trikala, which is an important livestock production area located in central Greece. Data on worm control practices of farmers may help protect the region's livestock economy by pinpointing potential risk factors for resistance development and by planning effective communication channels for educating the farmers on appropriate parasite control strategies.

Materials and methods

Data on nematode parasite control practices and profile characteristics of sheep and goat farmers in the region of Trikala were collected through a questionnaire survey during the autumn of 1997. The questionnaires were completed by investigators on location by visiting farms and directly interviewing the farmers in order to avoid misunderstanding in the completion of the questionnaires. The interviewer confirmed the statements of the farmers by inspecting the farm. A stratified sampling of rural communities by size of their farms, distance from an urban centre and local geography (mountainous, hilly, plain) was used.

The questionnaire comprised four sections, namely demographic characteristics of farmers, farm description, hygienic management of farm, and worm control practices. Data from the collected questionnaires were analysed using *MINITAB for Windows, Release 10.1*. Percentage distributions for the various responses were generated and cross-tabulations were made between related responses. For the question on the type of anthelmintics used, anthelmintics were classified into six groups as defined by the Greek Administration on Pharmaceuticals. Data on anthelmintic use for the last four years (1994–1997) were analysed to show how anthelmintic classes had changed during this period by defining four types of changes similar to the ones used in a Danish survey (Maingi *et al*., 1996b).

Results

The region of Trikala has 146 rural communities where there are 4890 farms with 234,647 sheep and 3710 farms with 115,439 goats that contribute around 30% of the region's Gross Product (NSSG, 1995). Fifty seven farmers residing in 23 rural communities in the region of Trikala agreed to have their farms visited and to be interviewed for completion of questionnaires.

The profile of the farmers that emerged from this survey is that of a man (88%), 45–64 years of age (68%) whose educational level is mostly primary school and below (74%). Of the 57 study farms, 50 had on average 136 sheep and 20 had on average 104 goats. Table 1 presents the distribution of the 57 farms into five categories based on the number of animals on the farms at the time of the survey and the national statistics of Greece for Trikala for comparison (NSSG, 1995). Table 2 presents the distribution of the study farms based on the type of animals raised (no such data for the region of Trikala were available from the Statistical Services of Greece for comparison purposes), the type of livestock farming practised by the study farms, and the proportion of pasture lands and management practices of the study farms.

Sheep and goats on most of the farms (84–96%) grazed on unfenced communal land from March to October and on 7% of farms the animals also grazed on cultivated land during the same months. No farmer reported grazing during the months of December, January and February.

Lambs and kids up to one year old were mostly treated once a year (97% and 100% respectively), while adult sheep and goats were mostly treated once (48% and 69% respectively) or twice (48% and 25% respectively).

The groups of anthelmintics (as specified by the Greek Pharmaceutical Organisation) used in each of the last four years (1994–1997) are presented in table 3. The most commonly used anthelmintic groups were benzimidazoles and probenzimidazoles followed by salicylanides, substituted phenols and aromatic amines. For 1997, most of the farmers used only one anthelmintic group (66%) and a considerable number used two or more groups (23%). Eleven percent of farmers used no anthelmintic. When the farmers were asked whom they consulted to treat the animals, most replied that they consulted a veterinarian (71%) or other farmers (27%).

Changes in anthelmintic group usage during 1994–1997 are presented in table 4. Fifty nine percent of farmers used the same anthelmintic group for 3 or more years and 34% of farmers used two or more anthelmintic groups within the same year. Sixty eight percent of farmers who used the same anthelmintic group for 3 or more years and 91% of the farmers who used two or more anthelmintic groups in the same year indicated the veterinarian as their choice of information about the use of anthelmintics and worm control strategies.

Animals were treated with anthelmintics mainly at turn out (86%) and after parturition (31%) (table 5). The most common practice for estimating live weights for

Table 1. Distribution of the 57 study farms based on the number of animals per farm compared with national statistics for Greece in the region of Trikala.

Farm size (number of animals)	Number of farms with sheep (%)				Number of farms with goats (%)			
	National statistics		Present survey (n=50)		National statistics		Present survey (n=20)	
0–50	3550	(72.59)	9	(18)	2990	(80.59)	12	(60)
51–100	570	(11.65)	17	(34)	230	(6.19)	3	(15)
101–200	540	(11.04)	17	(34)	160	(4.31)	1	(5)
201–500	200	(4.08)	5	(10)	300	(8.08)	4	(20)
>500	30	(0.61)	2	(4)	30	(0.8)	0	(0)
Total	4890	(100)	50	(100)	3710	(100)	20	(100)

Table 2. Farm description and management (n = 57).

	Number	Proportion (%)
Farm animals		
Sheep only	37	65
Goats only	7	12
Sheep and goats together	13	23
Type of livestock farming		
Sheep farms	50	
Intensive		2
Semi-intensive		40
Range		58
Goat farms	20	
Intensive		0
Semi-intensive		5
Range		95
Type of pasture land		
Dry land		95
Wet land		5
Type of management practices		
Sheep and goats graze separately		65
Sheep and goats graze together		32
Sheep and goats graze with cattle		12
Use permanent pasture*		47
Rotate animals between pastures*		75
Anthelmintic treatment when moving animals to new pastures*		2
Farm animals graze together with animals from other farms*		82

*Multiple replies.

Table 3. Proportion (%) of farms by group of anthelmintics used from 1994 to 1997 (n = 56)*.

Anthelmintic group	1997	1996	1995	1994
Benzimidazoles and probenzimidazoles	77	77	48	20
Imidazothiazoles	2	2	0	0
Tetrahydropyrimidines	2	2	0	0
Avermectins	4	4	2	0
Salicylanides, substituted phenols and aromatic amines	30	30	14	2
Miscellaneous anthelmintics	0	0	2	2

*Only emphatic responses that a certain anthelmintic was used are presented.

calculating anthelmintic doses, was through visual perception using an average weight (96%).

Various anthelmintic formulations were ranked by the farmers on a preference scale of 1 to 4. Tablets and boluses were ranked as first choice by 96% of the farmers. Powder, granules and feed additives were ranked as second choice (54%), and injectables as third choice (50%). Oral drenches were the last choice (98%). The criteria used for selecting an anthelmintic were the veterinarian's recommendation (59%), purchasing price (39%), and for 2% of farmers the results from previous applications.

Table 4. Changes in anthelmintic usage during 1994–1997 (n = 32).

Pattern of anthelmintic usage	Proportion of farms (%)
No change for 3 or more consecutive years (AAA)	59
Slow change (ABBA)	7
Alternated annually (ABAB)	0
Continuous change	0
Used more than one class in a year	34

New rams and male goats for mating were introduced on 37% of the farms as new purchases or as loans (12%) but only 6% of the farms reported deworming the new animals before introduction (table 5).

Veterinarians (63%) and other livestock farmers (37%) were the only sources of information for the use of anthelmintics and worm control practices chosen by the farmers. All the farmers who did not use any anthelmintic

Table 5. Timing of anthelmintic treatments (n = 51).

Anthelmintic treatment practice	Proportion of farms (%)*
At turn out	86
After parturition	31
When new animals are introduced in the farm	6
At the end of the grazing season	16
Spring	10
Autumn	10
Other occasions	2

*Multiple replies.

in 1997 indicated another farmer as their information source, while 100% of the farmers who used two or more anthelmintic groups in the same year of 1997 indicated the veterinarian as the source of information. The higher the educational level of the farmers, the higher the proportion who indicated the veterinarian as the information source.

Discussion

Questionnaire surveys of worm control strategies, with the purpose of identifying those practices that may contribute to local development of anthelmintic resistance, have been carried out in various countries, usually by post. To reduce the limitations of postal surveys such as low return rates, incomplete responses, misunderstandings, low validity, and reliability (Maingi *et al*., 1996b; Coles, 1997) the questionnaires in the present survey were completed by the authors while interviewing farmers and inspecting the farm. In this way the relatively low number of farms surveyed was compensated by the high validity of the information obtained in the present study which covered not only the practices of farmers on farm management and worm control strategies, but also their personal characteristics for planning effective communication channels for their education on parasite control strategies.

Control of economically important internal parasites in Greece is usually carried out according to a 'blind treatment' method (Himonas, 1976) where treatment is repeated three times per year, every winter, spring and autumn due to the lack of precise epidemiological data. The results of the present survey indicated that anthelmintics were used by the majority of sheep and goat farmers in the region of Trikala. The low number of treatment frequencies recorded in the present study should delay the development of anthelmintic resistance since small intervals between treatments increase selection pressures (Donald, 1983) and a high frequency of treatments has been associated with the appearance of resistance on farms (Kettle *et al*., 1983).

Sheep and goat farming in the region of Trikala is predominantly free-range, where farmers graze their flock on unfenced communal areas. Only 2% of farmers reported treatment of animals with anthelmintics when moving to new pastures, which is considered to enhance the development of anthelmintic resistance (Coles & Roush, 1992). Mixed or alternate grazing of sheep and goats with other species to dilute pasture infectivity was not practised. The practice of a considerable proportion of farmers to spread uncomposted manure on cultivated land which is used for grazing may lead to the build up of parasites in pasture.

The practice of farmers in this study to keep or graze sheep and goats together may favour the development of anthelmintic resistance as there is evidence that selection for resistance is higher in goats (Gillham & Obendorf, 1985; Waller, 1987).

The most common broad-spectrum anthelmintics used were those belonging to Class I, the benzimidazoles and probenzimidazoles. Fifty nine percent of farmers used the same anthelmintic group for 3 or more years and 34% used two or more anthelmintic groups in the same year. Both practices may lead to selection for anthelmintic resistance. On the other hand, no one practiced alternate uses of anthelmintics on an annual basis as generally recommended (Coles & Roush, 1992).

Almost all the farmers estimated live weights for calculating anthelmintic doses through visual perception on the basis of an average weight animal. This practice leads to underdosing (Coles & Roush, 1992) which has been associated with the development of anthelmintic resistance (Edwards *et al*., 1986). On the other hand, tablets and boluses were the most preferred anthelmintic formulation used by almost all farmers. This has the advantage of avoiding any inaccurate dosing by drenching guns. Treatments with tablets and boluses are mostly long-lasting so the interval between treatments becomes smaller than would be the case with other formulations, thus increasing the selection pressure for resistance. Selection of an anthelmintic was based for most of the farmers on the recommendation of a veterinarian and on the cost of the drug. Cost as a selection factor is not a problem as long as it is used within anthelmintic groups (Coles, 1997) but it would be surprising if the farmers were not influenced by cost, at least in the initial choice of anthelmintic.

The most common times for deworming the animals were at turn out and after parturition. These practices reduce pasture contamination by adults and infections of lambs and kids. On the other hand, there is always the danger of resistance development by importing animals onto the farms (Coles & Roush, 1992) since only 6% of farmers reported deworming the new animals before introduction. Such imported resistance has been already described in Greece (Himonas & Papadopoulos, 1994).

The personal characteristics of sheep and goat farmers in the region of Trikala, i.e. middle aged with low educational level, may partially explain the farmers' preference to seek information about the use of anthelmintics and worm control strategies from other farmers and not from journals and meetings. On the other hand, farmers who preferred veterinarians as their source information did not use the anthelmintics correctly, suggesting that the veterinarians themselves were not well informed about the proper use of anthelmintics.

In conclusion, the worm control practices of many sheep and goat farmers in the region of Trikala are not in line with general recommendations for avoidance of anthelmintic resistance (Coles, 1996). Specifically, farmers (i) do not take measures to avoid introducing resistant worms onto their farms; (ii) underdose by guessing animal weights; (iii) change anthelmintic groups more than once a year; (iv) use the same anthelmintic group year after year; and (v) keep sheep and goats together on the same pasture. On the other hand, worm control practices which help avoidance of anthelmintic resistance include grazing on extensive common pasture land and the low number of treatments per year.

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