

A LONG TERM STUDY ON THE PREVALENCE OF GASTROINTESTINAL, HEPATIC AND PULMONARY PARASITISM IN ADULT SHEEP FROM SALAMANCA PROVINCE, WESTERN SPAIN

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ABSTRACT: The prevalence of some intestinal protozoa and helminths of sheep in Salamanca (Spain) was studied from 1986 to 1994. Analysis of 4348 faecal samples showed that 3587 (82.5%) were infected with some parasite and 2032 (46.7%) with mixed infections. During the study period the prevalences were: 34.9% for *Eimeria* sp.; 72.0% for Strongylida of the gastrointestinal tract (*Strongyloides*, *Oesophagostomum*, *Clabertia*, *Bunostomum*, *Trichostrongylus*, *Teladorsagia*, *Cooperia*, *Haemonchus* and *Nematodirus*); 9.2% *Trichuris ovis*; 12.6% *Dictyocaulus filaria*; 8.4% Protostrongylidae (*Cystocaulus*, *Protostrongylus*, *Muellerius* and *Neostrongylus*); 8.8% *Moniezia* sp. and *Stilesia* sp.; 9.1% *Fasciola hepatica*; and 0.3% *Dicrocoelium dendriticum*. The results of this study obtained by observations during nine years yield information which reflects the true prevalence of these parasitic infections in the sheep of our study area.

KEY WORDS: Parasites, prevalence, sheep, Salamanca, Spain.

INTRODUCTION

The sheep of the province of Salamanca represent 3.45% of the approximately 24.5 million sheep in Spain. They are natural hosts to some 40 species of protozoa and helminths which principally occupy the gastrointestinal tract, the liver and the respiratory apparatus (RAMAJO-MARTIN, 1992; CORDERO DEL CAMPILLO, CASTAÑON & REGUERA, 1994).

Parasitic infections of sheep cause important economic losses and for their control it is necessary to know certain epidemiological aspects. The economic impact has been indicated recently by numerous authors throughout the world (HERLICH, 1978; COOP, 1982; CAWDERY, 1984; DARGIE, 1987; GOODALL *et al.*, 1991; ROOD *et al.*, 1992; BENESCH, 1993). In Spain this parasitism has been demonstrated as a principal negative factor in ovine production (FLORES, 1981; COMPAIRÉ & TARAZONA, 1985). The benefits of the control of these infections are generally accepted (NANSEN, 1987; WAMAE & IHIGA, 1991).

The principles of the control in countries with a temperate climate and where sheep graze pasture, as occurs in the province of Salamanca (Spain), are based on the data which comprise the local epidemiological models (BRUNSDON, 1980; SIMON-VICENTE & RAMAJO-MARTIN, 1985; ROJO-VAZQUEZ *et al.*, 1994).

The objectives of this work are to find new data on the prevalence of the gastrointestinal, pulmonary and hepatic

parasitic infections of sheep in this Spanish region and the trends in these infections during the last nine years.

MATERIAL AND METHODS

The study area: This study was carried out in the province of Salamanca, situated in the western part of Spain at some 800 meters above sea level (Fig. 1A). The climate is hot and dry in summer, temperate in spring and autumn and cold in winter. The average maximum temperature is 20-24° C in July-August and the average minimum 2-6° C in December-January. The average annual rainfall in the study area in 1986-1994 was 563±180 mm, with a very dry period in summer which persists from one to four months. It is considered to be a semi-arid region with a temperate climate (D. LEON LLAMAZARES, 1990).

Sheep: All of the sheep included in this study were farmed in an extensive system. A total of 4348 ewes (2-7 years) from 50 sites (= farms), were examined by individual sampling. This sampling was uniformly distributed throughout the study area and carried out at all times of the year, from January 1986 to December 1994 (Fig. 1B).

Parasitological techniques: A modification of PARFITT's technique (1958) was used. Briefly, this consists of the homogenization and suspension of 3 g of faeces in 42 ml of water, filtering through a 350 mm mesh and centrifuging in 15 ml tubes at 1500 rpm for 3 min. The pellet was resuspended in a 33% zinc sulphate solution, adapting a slide cover to the meniscus of the tube. After further centrifuging to accelerate the process of flotation, the slide cover was removed and observed under a light microscope to identify the parasite eggs and larvae. For the identification of some genera of

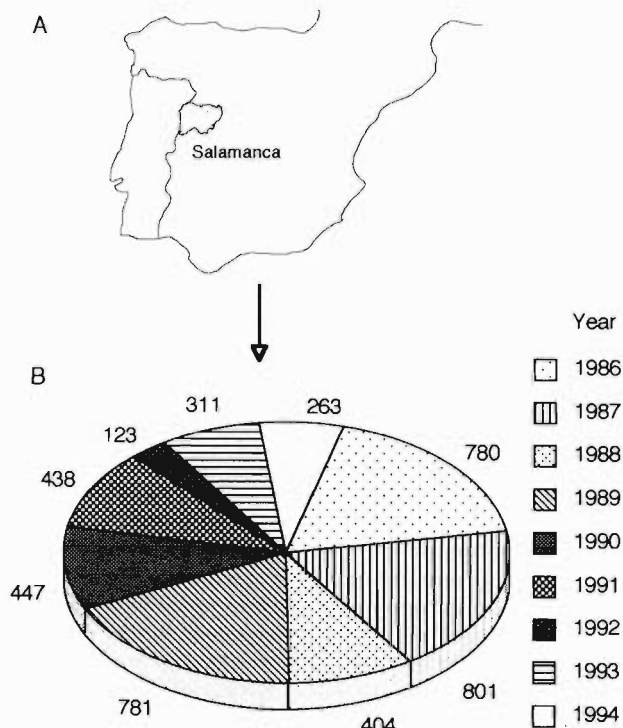


Fig. 1.—Parasitological study of adult sheep in Salamanca province: A) geographical localization of the study area (Salamanca province) in the Iberian Peninsula; B) annual distribution of sampling.

Strongylida of the gastrointestinal tract, we carried out larvae cultures of pooled samples of each site.

RESULTS

The analysis of the 4348 samples of faeces showed a wide spectrum of infection in the course of the nine years of the study.

The parasites belonged to various groups and included: intestinal protozoa (*Eimeria*), trematodes (*Fasciola hepatica*, *Dicrocoelium dendriticum*), adult digestive cestodes (*Moniezia*, *Stilesia*), nematodes of the gastrointestinal tract (*Strongyloides*, *Oesophagostomum*, *Chabertia*, *Bunostomum*, *Trichostrongylus*, *Teladorsagia*, *Cooperia*, *Haemonchus*, *Nematodirus* and *Trichuris*) and pulmonary nematodes (*Dictyocaulus filaria* and Protostrongylidae: *Protostrongylus*, *Cystocaulus*, *Muelle-rius*, *Neostrongylus*).

Of the 4348 samples, 3587 (82.5%) were infected and 2032 (46.7%) with mixed infections. Of the total of the sample, 35.8% were positive for a single type of parasites, 27.5% for two, 14.3% for three and 4.9% for four or more.

The prevalences of the different groups of parasites from 1986 to 1994 were very variable, the *Eimeria* and the digestive Strongylida reaching the highest level (Table 1).

Zoological groups	positive samples	prevalence (%)
Protozoa <i>Eimeria</i> spp.	1517	34.9
Digenea <i>Fasciola hepatica</i>	395	9.1
<i>Dicrocoelium dendriticum</i>	11	0.3
Nematoda Strongylida	3132	72.0
<i>Trichuris ovis</i>	401	9.2
<i>Dictyocaulus filaria</i>	548	12.6
Protostrongylidae	364	8.4
Cestoda <i>Moniezia</i> , <i>Stilesia</i>	381	8.8

Table 1.—Prevalence of the different groups of parasites from 1986 to 1994.

The trend of the prevalence of intestinal protozoa is presented in Fig. 2A. The prevalence of *Eimeria* infection was relatively low during the first three years (under 20%), rising later to 77.8% and decreasing to stabilization in the latter years to around 40-45%.

In Fig. 2B the profile of the prevalences of *Fasciola hepatica* and *Dicrocoelium dendriticum* are shown. *Fasciola* presents prevalences between 3.8% and 16.8% with increases or decreases according to the years. *Dicrocoelium* was always detected in very low proportions.

The most prevalent group was that of the digestive strongylids, which belong to various genera that are very common throughout the world. The proportions of sheep infected by them were the greatest found in the whole study, varying by year between 65.4% and 85.9% (Fig. 2C). *Trichuris ovis*, a nematode of the large intestine, appeared very variable, with maximum prevalence up to 21.7% in 1990, diminishing gradually during later years.

Of the pulmonary nematodes (Fig. 2C), *Dictyocaulus filaria* showed prevalences between 8.6% and 26%, with highest figures recorded in the period 1991-1993. The Protostrongylidae maintained their presence between levels of 3.7-11.8%.

The presence of digestive cestodes varied between 4.9-10.7% (Fig. 2D).

DISCUSSION

All the parasites identified in this study are habitually found in Spain and have been reported in the ovine parasitofauna of the province of Salamanca (RAMAJO-MARTIN, 1992) and collected in the Index Catalogue of Iberian Zooparasites (CORDERO DEL CAMPILLO, CASTAÑON & REGUERA, 1994).

The global results of our study, with regard to prevalence and levels of association among the parasites described, are similar to those obtained respectively by AMBROSI (1992) and GRUNER *et al.* (1992) in Italian and French areas with a Mediterranean climate.

The prevalence of coccidia increased considerably in 1989 and 1990. This high prevalence is attributed to autumns and springs with higher levels of rainfall. The pre-

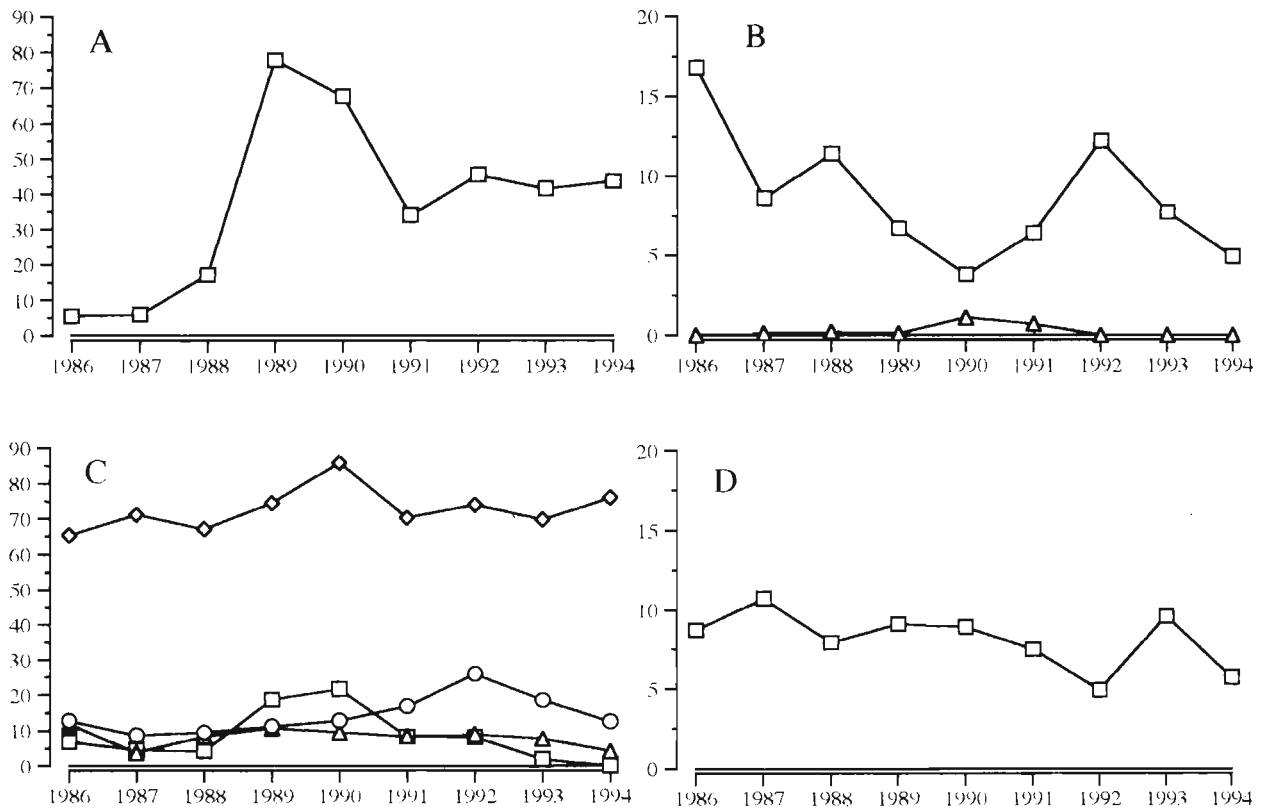


Fig. 2.— Evolution of parasite prevalences in adult sheep in Salamanca province: A) *Eimeria* spp.; B) trematodes (\square *Fasciola hepatica*, Δ *Dicrocoelium dendriticum*); C) gastrointestinal nematodes (\diamond Strongylida, \square *Trichostrongylus axei*, \circ *Dictyocaulus filaria*, Δ Protostrongylidae); D) tapeworms (*Moniezia* and *Stilesia*).

sence of these in adult sheep and the ascendant tendency observed are of great importance to the development of coccidiosis in lambs. Similar results have been indicated in other Spanish zones (FERRE, CALVO & ROJO-VAZQUEZ, 1991) and in central European zones (BENISCH, 1993).

Among the trematodes, the most prevalent was *Fasciola hepatica*, which persists here at moderate levels comparable with those of some south and east-central zones of Spain (PEINADO, 1989; MANGA *et al.*, 1990; FERRE, CALVO & ROJO-VAZQUEZ, 1991; FERRE, 1994) and lower than those indicated in the north-east and north of Spain (URIARTE, CABARET & TANCO, 1985; GARCIA-PEREZ & JUSTE-JORDAN, 1987) and in certain locations of the southern European area (Basilicata, Italy), where prevalences of up to 60% have been cited (QUESADA *et al.*, 1991).

Dicrocoelium dendriticum is rare in our region in contrast to other Spanish sheep-producing regions, where relatively high prevalences have been reported (URIARTE, CABARET & TANCO, 1985; FERRE, CALVO & ROJO-VAZQUEZ, 1991; MANGA, GONZALEZ-LANZA & DEL POZO, 1991; FERRE, ORTEGA & ROJO-VAZQUEZ, 1994), similar to the situation in other European regions: Italy (QUESADA *et al.*, 1991), Germany (SCHUSTER,

MEINEL & HIRSCHMANN, 1991), Northern Ireland (GOODALL *et al.*, 1991).

The cestodes Anoplocephalidae (*Moniezia* and *Stilesia*) persist here in low proportions, similar to those in other Spanish regions with similar conditions (FERRE, CALVO & ROJO-VAZQUEZ, 1991). Nevertheless, this moderate level could be of notable interest because of the important role played by the adult sheep carriers as reservoirs of the cestodosis of lambs, which acquire a notable pathological consideration on some farms in our study area.

The nematodes of the gastrointestinal tract, especially the Strongylida, with a practically cosmopolitan distribution, also present relatively moderate levels here in comparison with the high prevalences they maintain in all the humid and temperate regions of the world. This is due to the limitation which the scarcity of rainfall supposes for their exogenous development. Their prevalence in the province of Salamanca is similar to that observed by other authors in central and north-western areas of Spain (DIEZ-BAÑOS, 1989; FERRE, CALVO & ROJO-VAZQUEZ, 1991) and of a lower level than that found in the north and north-east of Spain (URIARTE, CABARET & TANCO, 1985; GARCIA-PEREZ & JUSTE-JORDAN, 1987) or in other regions of Europe (SUSMEL *et al.*, 1992).

Among the pulmonary nematodes, *Dictyocaulus filaria*, of great pathogenic interest, seems to maintain discrete levels of prevalence, as in the rest of Spain (FERRE, CALVO & ROJO-VAZQUEZ, 1991) or in certain central European regions such as Belgium (VERNAILLEN & PAQUAY, 1990). The Protostrongylidae, considered in Spain as the causes of important infections (CORDERO DEL CAMPILLO & ORDOÑEZ, 1989), have a proportionally lower prevalence in the province of Salamanca than those observed in other arid or semi-arid zones of Spain (FERRE, CALVO & ROJO-VÁZQUEZ, 1991) and very much lower than those indicated in the humid regions of Spain (DIEZ-BAÑOS *et al.*, 1994) or in Belgium (VERNAILLEN & PAQUAY, 1990).

In spite of the generalization of the strategic-preventive treatments which have been carried out in recent years against all these parasites, their prevalences seem to persist, both in our region and in others of the European area. The effectiveness of this type of control method seems to be limited to the restriction of the parasites' relative density or abundance.

The majority of prevalence studies are based on observations that are generally rather limited in time, and which consequently offer specific information, more proper to the concept of temporary and seasonal incidence. Thus, the results of our study obtained from prolonged observation over a period of nine years yields information very close to the prevalence and trend of these parasites in the sheep in our environment.

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