SITUATION OF SHEEP HEALTH IN THE COMMUNE OF ANALAVORY

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ABSTRACT

Despite the economic importance at both regional and global level, data on the health situation of sheep remains insufficient in Madagascar, even in places like Analavory which seems to be the second largest in small ruminant breeding. Thus, the objective of this study is to identify the main pathologies of sheep in the commune of Analavory and to identify the factors associated with these pathologies. This study was carried out among sheep farmers by direct observation of the number of sheep diseases existing on the farms. Two parameters were used to assess the state of health of the sheep on the farms (prevalence of each dominant sheep disease at farm level and the number of diseases on each farm). The main pathologies encountered in sheep are Enzootic Pneumonia/ Verminous Bronchopneumonia (EP/VB), foot rot, scab, ringworm and phthoriosis. Based on our analysis of the relationship between the diseases encountered and the factors that could influence them, we found that the mix of the herd, the non-respect of the sheepfold, the type of open sheepfold, the non-practice of deworming, and the The use of wells as a source of drinking water are the factors linked to the onset of these diseases. The main factors considered in this study did not have a significant effect on the disease burden on each farm. This lack of significance may be due to the lack of mastery of the professional breeding technique of the breeders. It is therefore necessary to strengthen cooperation between veterinarians and breeders.

Keyword: - *Analavory commune, health situation, and sheep farmers.*

1. INTRODUCTION

As part of the short-cycle animals, sheep, for their meat, milk, hair or wool and leather are an important economic issue both regionally and globally [1]. As a result, knowledge of diseases affecting sheep is really essential in order to reduce the costs related to diseases, to optimize production costs and above all to propose corrective actions [2]. The world health situation of sheep is characterized, for diseases falling within the scope of the Office International de l'Epizootie (OIE), by the predominance of foot-and-mouth disease, bluetongue and clavelée, and for diseases not falling within the scope of the Office International de l'Epizootie (OIE), by digestive pathologies of nutritional or

metabolic origin whether in Africa , in Asia (China and India), in Europe in America (Paraguay), in Oceania, and in the Mediterranean countries ... [3] [4] [5].

In Africa, the most common diseases are helminthoses, ectoparasitoses, vector-borne diseases (cowdriosis, babesiosis, trypanosomiasis), contagious ecthyma, anthrax, bluetongue, foot-and-mouth disease, contagious nodular dermatosis, peste des petits ruminants (endemic) and Rift Valley fever [3] [6] [7].

In Madagascar, the sheep population numbered 730,000 in 2013 [8]. Cowdriosis, contagious Echtyma, bluetongue, contagious nodular dermamatosis, dermatophilosis, anthrax, symptomatic anthrax and Rift Valley fever have been the subject of clinical surveillance for several years by the International Organization of Epizootic Disease or OIE [9]. According to the few previous studies carried out on the health situation of sheep on the island, the diseases not included in the OIE's priority are the digestive (moneziosis, fasciolosis, indigestion) and skin (scabies, tick) pathologies that predominate there. In the commune of Analavory, data on the health situation of sheep remain insufficient and not updated [9] [10] [8]. For this sheep sector, the question arises: what is the health situation of sheep in the commune of Analavory? As a hypothesis, the health situation of sheep in the commune of Analavory is characterized by the predominance of digestive and skin pathologies.

This study has two interests as scientific and medical, because it allows access to the research of the main diseases that affect sheep in the said Commune, and to guide on the decision-making concerning the measures to be adopted for the control of the distribution of diseases. The objective of this study is to identify the main pathologies of sheep in the commune of Analavory and to identify the factors associated with these pathologies. Specifically, it is a question of determining the most marked clinical signs, identifying the main pathologies of sheep within the Commune, and examining the relationship between these breeding practices and the main pathologies of sheep in the Commune of Analavory.

2. METHODOLOGY

2.1 Site of the study

The present study was carried out in the commune of Analavory in the district of Miarinarivo of the Itasy Region. The study concerned five fokontany (basic administrative subdivision at the commune level) comprising 30 farms. These fokontany are Andranonatoho, Ambatondramijay, Marosoko, Bengitsy and Ankonabe.

The Commune of Analavory is located in the heart of Madagascar, 111 km west of the capital of Antananarivo and 22km west of Miarinarivo. Its geographical coordinates are 18°58'S latitude and 46°43'E longitude. It has an area of 406 km2 and is composed of 23 fokontany. It is bounded to the north by the commune of Anosibe-Ifanja, to the east by the urban commune of Miarinarivo, to the west by the commune of Alatsinainikely and to the south by the commune of Ampefy.

Fig -1: Location of the commune of Analavory (source: BD200 FTM 2011 illustrated with Adobe photoshop illustrator)

The Itasy Region happens to be the second region, behind the Southern Region in terms of concentration area in small ruminant farming. In this Region, the breeding of small ruminants is dominated by that of sheep. The livestock of the latter in this Region is divided between the district of Arivonimamo (85.5%) and the district of Miarinarivo (14.5%).

If initially, the district of Arivonimamo was envisaged to be the site of the study because of its high potential in sheep farming in the Region of Itasy, after a preliminary descent, it did not prove possible to carry out the descent because of its inaccessibility on the road. Thus, after the preliminary descent, five Fokontany in the Commune of Analavory of the District of Miarinarivo were chosen as a study site because compared to all the municipalities of the District of Miarinarivo and compared to the other Fokontany of the Commune of Analavory, they are the most concentrated in sheep farming. In addition, no study on the health situation of sheep has yet been carried out in this commune [10] [12] [13].

2.2 Data collection

This is a study on the main sheep diseases from September 2015 to August 2016 (12 months). This study was carried out among sheep farmers by direct observation of the number of sheep diseases existing on the holdings.

Information on sheep farming practices and the main sheep diseases encountered on farms was obtained through direct observations. As for deworming, the data were obtained from health books.

The observation was not carried out only with the consent of our school, the local sanitary veterinarian, the fokontany chiefs and the breeders. A clear explanation of the purpose, methods and expected benefits of the study was given to breeders before any activity. The breeders were free in their answers to the questions asked. They were not subjected to any constraints or pressure. No judgment on their way of life or on their attitude has been made. Comments remained on the information needed for the study. The identification of breeders was carried out by coding and not by their names. The sheep were observed without injuring or traumatizing them. The results of the observation are used only for scientific purposes.

2.3 Data analysis mode

The data was saved and stored under the spreadsheet of Microsoft Office Excel 2007, then processed and analyzed using SPSS version 22.0 software (SPSS Inc., IBM, Chicago Illinois).

Two parameters were used to assess the state of health of sheep on the holdings studied, namely:

The prevalence of each dominant ovine pathology at farm level

The number of diseases on each holding

The prevalence of each dominant ovine pathology at farm level corresponds to the total number of farmers with sheep affected by a disease during a given period (12 months) in relation to the total number of farmers in the sample. It is expressed as a percentage (%).

$$\frac{Number\ of\ farmers\ with\ sheep\ with\ disease}{Total\ number\ of\ farmers} \times 100$$

For the analysis, Pearson's χ^2 test is used to test whether there is a significant association between the diseases encountered and the factors that could influenced them. The Generalized Linear Model (with Poisson distribution and identity link function) is used to examine the effect of the main factors on the disease burden (number of diseases) in each holding.

The main explanatory variables or factors that could have predictive effects on the number of diseases encountered were:

- The mix of livestock
- The size of the herd
- The duration of exploitation
- The type of sheepfold
- Respect for sheepfold
- The provision of food supplement
- The source of drinking water
- The frequency of cleaning sheepfold
- The practice of deworming

3. RESULTS

Of the 30 farms observed, 28 farms are affected by the clinical signs corresponding to the pathological entity Enzootic pneumonia / Bronchopmneumonia verminous (EP/VB); 13 farms are affected by the foot rot; 6 scabies; 5 farms by ringworm and 3 farms by phtiriosis. The order of importance of the diseases encountered in these farms is characterized by the predominance of Enzootic pneumonia / Bronchopmneumonia verminous (EP/VB) (93.3%), followed by foot rot (43.3%), then scabies (20%), ringworm (16.6%) and finally phtiriosis (10%).

According to Pearson's χ^2 tests, we found that:

- EP/VB has a significant relationship with herd mix (χ^2= 6.467; ddl= 1; p= 0.011) and sheepfold non-compliance (χ^2= 10.714; ddl= 1; p= 0.001)
- Scabies has a significant relationship with open sheepfold type (χ^2= d 7.873; ddl= 1; p= 0.005) and the invenient deworming (χ^2= 8.571; ddl= 1; p= 0.003)
- Phtiriosis has a significant relationship with the use of wells as a source of water for water (χ^2= 8.205; ddl= 1; p= 0.004)

For ringworm and foot rot, we did not find significant relationships between these diseases and husbandry practices (see appendix).

Based on the analysis of generalized linear models, we did not find significant effects of the main factors on the disease burden (number of diseases) in each holding (χ^2=6.346, ddl= 1; p= 0.500)

4. DISCUSSION

The health situation of sheep in the commune of Analavory is characterized by the predominance of respiratory (EP/VB) and skin (scabies, phtiriosis, ringworm and pietinum) pathologies. Regarding respiratory pathology, the entity Enzootic Pneumonia / Verminous Bronchopneumonia is the only suspected disease in the study area. These two diseases have been grouped into a single pathological entity because their distinction cannot be made on the basis of declarative information from breeders alone. Indeed, these two diseases have clinical signs in common. These clinical signs that we observed are chronic cough accompanied by breathing difficulties, muco-purulent jetting and progressive weight loss. Thus, an autopsy is necessary to arrive at a certain diagnosis. The suspicion of enzootic pneumonia is confirmed only at autopsy with the finding of characteristic lesions (anterior pulmonary lobes with gray to brownish red hepatoization) possibly accompanied by pleurisy [14]. The germs in question can be demonstrated by carrying out a bacteriological culture. For verminous bronchopneumonia, its diagnosis is also confirmed by searching from the feces or during the autopsy of parasites. During autopsy, adult parasites in the bronchi and lesions of bronchitis, emphysema and atelectasis are to be observed.

Foot rot is the second most common suspected disease of sheep in the Commune of Analavory. Appearing most often in the rainy season, the clinical signs of the foot rot observed are lameness, lesions between the two fingers of the animal's feet (wet, swollen skin with the appearance of a wound), a putrid smell of the foot and lameness.

Scabies is the third suspected disease of sheep (5%) the most common in the Commune of Analavory. Appearing especially during the dry season and zoonotic in nature, the clinical signs of scabies observed are an intense pruritus descending from the ear, then from the head, neckline, thorax, back, flanks, rump and, finally, limbs; a strong depilation that invades the entire body of the animal, excoriations due to violent pruritus (Animals scratch and rub to the point of causing depilations, excoriations and the formation of yellowish crusts more or less bloody), thickening of the skin, a decrease in consumption of the animal and a gradual weight loss. In general, lesions of depilation, crusts and hyperkeratosis associated with violent pruritus are sufficient for the diagnosis of scabies. These symptoms that we observed correspond more to psoroptic type scabies. Numerous studies have shown that psoroptic scabies is the most common and major in sheep [15] [16] [17] [18] [19]. A study conducted in 1988 in the south of Madagascar confirmed that in sheep, psoroptic scabies is the most common and that it reaches the region covered with wool, especially the lumbosacral region of the animal with the formation of fatty crusts and wool that falls by plates [19].

Ringworm is the fourth suspected disease of sheep (4%) the most common in the Commune of Analavory. The symptoms we observed are the presence of depilation area of grayish color, circular in shape and not itchy on the skin of animals. These lesions were found mainly on the head and neckline, sometimes the chest and back and the condition can spread to the woolly parts. Moth lesions (rounded alopecic zone, up to 10 cm in diameter accompanied by thick, grayish crusts but without pruritus) are sufficiently evocative to allow a reliable diagnosis or suspicion from declarative information from breeders.

Phtiriosis is the fifth disease suspected in the study area. The symptoms observed are the presence of strongly localized lice on the tip of the nose, around the eyes, on the withers, neckline, on the back, on the flanks and tail, marked pruritus, depilation (much more moderate than those visible during scabies) at the level of the head, neck and back; dander, excoriations, a decrease in animal consumption and weight loss. Infestation by lice is differentiated from scabies and bites of diptera. Nevertheless, clinical and epidemiological elements, as well as direct observation of parasites are usually sufficient to make the diagnosis of phtiriosis. The action of parasites associated with scraping movements leads to wear and breakage of the hairs resulting in depilations associated with a significant formation of scales. Scratching movements are also at the origin of the formation of excoriations. Pruritus, has as consequences, a decrease in food intake and a sharp decrease in the general condition, with weight loss and drop in milk production.

The result on the predominance of EP/VB is comparable to that of the survey on goat farming in the highlands of Western Cameroon which showed that pneumonia and respiratory diseases are the most mentioned diseases by breeders (60.6%), followed by diarrhoea (57.2%) and dermatoses (37.6%).

The result on the prevalence of foot rot is lower than that of a study on the prevalence of foot rot in sheep in tropical areas of southern India which is 15% [20].

The result on the distribution of diseases is not comparable to that of a study on the pathologies of small ruminants in Togo whose sheep diseases are distributed as follows: 43.1% of peste des petits ruminants, 32.1% of digestive pathology and 16.4% of skin pathology [21]. According to the investigation in Togo, the suspected diseases belonging to the digestive pathology are intestinal parasitism, poisoning with soybean or cotton seed; and plastic bag syndrome.

The result on the prevalence of sheep scabies on farms in the Commune of Analavory is not comparable to that of the study on the pathologies of small ruminants in Togo which found a prevalence of 5.3% of small ruminants with scabies [21].

The result on the prevalence of ringworm is higher than that of the study on the pathologies of small ruminants in Togo which is 1.5% [21]. The result on the prevalence of phtiriosis is higher than that of the study on the pathologies of small ruminants in Togo which found a prevalence of 5.2% of small ruminants with pulicosis (massive infestation of fleas or biting lice bloodsucking) [21].

This predominance of respiratory pathology is due not only to the extensive management of herds but also to the sensitivity of sheep to the stress factor (climate change, ventilation in the sheepfold insufficient or in excess, high concentration of ammonia in the sheepfold, confinement, food deficiencies) resulting in a decrease in their means of defense thus favoring the appearance of respiratory pathologies especially enzootic pneumonia. Indeed, the pathogens (pasteurelles) responsible for the latter being normal hosts of the upper respiratory tract of ruminants, therefore do not as a rule cause respiratory problems unless other factors are combined, both stressors and initiator microbial factors (Adenoviruses, Herpes virus of cattle type 1, respiratory syncytial viruses, para-influenza virus type 3, Mycoplasmas, Chlamydia, Rickettsia and parasites). It is these stressors that interact to lead to a state of immuno-depression allowing pasteurelles to fully express their pathogenicity [14].

This prevalence of foot rot on farms may be due to the exposure of animals to the factors favouring the appearance of this disease. The factors favoring the appearance of foot rot are moist soils such as wet pastures (especially in the rainy season) and dirty sheepfolds containing non-evacuated slurry; a diet deficient in zinc, vitamin A and amino acid. The risk of hoof injury and cases of lameness in ruminants increase if ruminants are forced to stand on wet surfaces because their hooves will quickly become softer. Indeed, the infection is favored by a humid and mild climatology for sheep living outdoors. The germs responsible for the foot rot being anaerobic germs, its inoculation is facilitated by the traumas of the pedal region, due to the heating of the furnace following the accumulation of mud, but also by the stony soils. For sheepfolds, it is poor rearing conditions and manure accumulation that facilitate infection. Podal pain is more intense for heavy animals and especially in the absence of maintenance of the foot. The infection is transmitted mainly through soil contaminated by one or more infected sheep [14].

This prevalence of scabies on farms is due to the condition of breeding; malnutrition, promiscuity between sick and healthy animals and a hot and humid climate. Animals are more susceptible and the disease is more severe in poorly maintained farms. Contaminated materials (e.g., food, scraping point such as trees, droppings and urine) are sources of indirect contamination. Poor skin hygiene, soiling by feces and urine, are real sources of skin irritation, thus raising the sensitivity of animals. Dietary deficiency and especially a diet deficient in vitamin A and minerals promotes the development of mites on animals [22]. While knowing the contagiousness of this disease, the measures that breeders take in front of it in order to limit its transmission and its spread are the separation of sick animals from healthy and to wait for the natural death of these sick animals. However, several acaricides or systemic products such as ivermectin exist to treat scabies. The prognosis of scabies is still serious, both medically and economically because of its rapid and easy contagion to all herds, weakening of affected animals, devaluation of skins, wool losses and significant mortality [23].

This prevalence of ringworm on farms is due to the extensive conduct of livestock farming which predisposes animals to the development of ringworm. Not all animals in contact with this fungus necessarily develop the disease. There are factors predisposing the development of this disease so the appearance of lesions, these are: heat, humidity, young age, poor animal health (deficiency of immunity, food deficiency, other concomitant disease,), an inadequate environment (dark environment, confinement, poor ventilation, significant humidity, poor hygiene ...), overpopulation in the habitat) [24]. The fungus needs moisture and heat to grow. Faced with this disease, breeders do not take any action because they consider that it is not a serious disease. For them, an animal is considered sick only when it is moribund. Several products exist for the treatment of ringworm. As part of the fight against this disease, the literature confirms that when a herd is reached, spores are present in large quantities in the litter,

therefore it is recommended to disinfect the livestock buildings with quaternary ammonium. Vitamin a supplement with vitamins A, D, E C and zinc should be given to these animals to strengthen their resistance [25].

This prevalence of phtiriosis in the study area can be explained by the promiscuity of the animals, the poor hygiene of the premises and the herd, malnutrition and the poor general condition of the animals [26] [27]. The proliferation of lice is favored by gatherings of animals. Nits can be found in the litter, thus constituting a source of indirect contagion. Any deficiency of the body leads to an aggravation of parasitism [14]. Indeed, massive infestations are often a sign of poor general condition of the animals and poor hygiene of the herd. They are more severe on debilitated animals suffering from malnutrition or intestinal parasitism. Weaning lambs are also very sensitive and phtiriosis is then associated with coccidiosis [22] [28].

This study revealed an influence of mixed livestock farming on the development of EP/VB. This result is not comparable with that of the study on goat pathology in Deux-Sèvres which did not find an influence of the presence of other animal workshops on the farm on the development of respiratory pathologies [29]. This result may be related to the extensive management of herds, which represents several stressors that alter the defense mechanisms of the animal organism favoring the appearance of enzootic pneumonia. Enzootic pneumonia is a bacterial disease in cattle, sheep and goats caused by Pasteurella haemolytica. So this disease is transmissible between these three species. Ruminants are naturally carriers of pasteurelles (agents responsible for enzootic pneumonia) in their nasal cavity. There is a reservoir and therefore a danger of contamination in each farm. In lambs, contamination occurs at birth by close contact with their mother and then from 5 days of age by contact between lambs. The transmission of these pasteurelles is done by direct contact via sneezing, coughing, nasal throwing, milk, etc., from a sick or carrier animal to a healthy animal. Finally, the pastures frequented by many species of animals (cattle, sheep, goats) together increases the risk of infestation of animals by ingestion of infesting larvae responsible for verminous bronchopneumonia [14].

Non-compliance with the sheepfold has an influence on the development of the Enzootic Pneumonia / Verminous Bronchopneumonia (EP/VB). This result is comparable to that of a study on the risk factors for respiratory diseases of calves in suckler cow farms in the Vendée, which showed that the density of the animals has a great influence on the appearance of these respiratory diseases. It is thus shown that the real risk of occurrence of respiratory damage is correlated with the concentration of calves in a building [30]. In addition, two studies in dairy calves in experimental stations and in bullfighting fattening highlight the exponential nature of the respiratory risk when animal density increases. For bull calves, going from 4.5 m² per cattle to 4 m² multiplies by 2 the frequency of respiratory diseases, the passage to 3.5 m² multiplies it by 4 [31]. The literature confirms that density plays on many parameters; degradation of environmental parameters (ammonia, humidity and temperature), greater ease of contact, increased stress induced by overcrowding and decreased food availability. Overpopulation leads to the development of poor farming conditions (temperature, humidity, air pollution, etc.), which promotes the risk of the appearance of lung diseases. In addition, the mixture of animals of different age classes and the excessive concentration of animals are also a risk factor in the development of pneumopptahies [14]. Since enzootic pneumonia is a contagious infectious disease, its transmission through direct contact between sick and healthy animals increases all the more the higher the animal density. As for verminous bronchopneumonia, the literature confirms that the sowing of grasslands increases according to the load of the animals and as the square of it: 1 strongle lays 10,000 eggs per day; if an animal carries 1,000 strongles, which is low, 10 million eggs will be expelled per day. Foot rot of the feces causes dislocation of the fecal gangue and release of infesting eggs and larvae. Short grasses and especially overgrazed parks are factors favoring parasitism. Parasitism is the essential debilitating factor for the installation of lung diseases in the conditions of traditional (extensive) livestock farming, which mainly exploits natural pastures [14].

This study revealed an influence of the type of open sheepfold on the development of scabies. This may be related to the poor condition of the breeding but especially to the sensitivity of sheep to the air run induced by the type of open sheepfold causing stress to these animals which will lead them to a weakening of the immune system, thus making them much more vulnerable to the disease [14] [23] [32].

The invenient deworming is related to the development of scabies. This result is comparable to that of the study on breeding in the Upper Mandrare Basin which showed that the insufficiency of deworming of cattle seems to have an influence on the development of scabies [34]. This invenient deworming can be explained by the fact that breeders are still poorly aware of diseases related to parasites. Indeed, scabies is a disease that still kills many animals while it can be treated by simple showering. In addition, many farmers consider that the prices of deworming products are

too expensive. Finally, unlike vaccination, there is no law requiring the deworming of animals; this could explain the lack of interest of breeders.

This study revealed a relationship between the use of wells as a source of water for drinking water and the development of phtiriosis. This relationship can be explained by the fact that animals with phiriosis suffer from intestinal parasitism which is one of the predisposing factors to the development of phiriosis. Indeed, the literature confirms that massive infestations by lice are more severe on debilitated animals, suffering from malnutrition or intestinal parasitism [22] [28]. Sheep in the study area are permanently at risk of parasitism because of the water sources these animals use. Indeed, in the study area, farmers have four sources of water (wells, rivers, rice fields and springs). Rivers, rice fields and springs are surface waters. These waters, often stagnant, are vulnerable to microbiological, parasitic and chemical pollution due to discharges from human activities and runoff. Each fokontany has a common drinking place. Rivers are for example sources of fasciolian infestation [34].

According to the result of the analysis by generalized linear models, the main factors have no significant effect on the load of ovine diseases encountered. There are many causes that can be at the origin of this lack of significance of the effects of the main factors on the number of diseases. This absence may be due to the fact that sheep are already carriers of disease before being integrated into the herd. Indeed, breeders are not in the habit of checking the state of health of animals when they are purchased. They do not quarantine newly purchased or received animals.

Concerning the health situation of sheep in the Commune of Analavory which is characterized by the predominance of EP/VB, followed by phtiriosis, then scabies, then foot rot and finally ringworm:

Health veterinarians in the region or district or commune concerned should establish strict deworming protocols and should also raise awareness and encourage farmers to use veterinarians and treat sick animals.

Health veterinarians should raise awareness and sensitize farmers on the importance of sheep farming: sheep can definitely contribute to food self-sufficiency in protein for many households and constitute a flexible financial reserve.

The Ministry of Livestock should put in place mentoring programmes for farmers in terms of training on good techniques for breeding small ruminants.

Farmers who wish to be professionals or who wish to enter the export trade in the sheep sector should follow international standards for sheep farming.

5. CONCLUSION

This study concludes that the health situation of sheep in the Commune of Analavory is characterized in order of importance, by Enzootic Pneumonia / Verminous Bronchopneumonia (EP/VB), foot rot, scabies, ringworm and phtiriosis. The EP/VB is linked to the mixing of the herd and the non-respect of the sheepfold. Scabies is related to the type of open sheepfold and the in-practice of deworming. Phtiriosis is related to the use of wells as a source of water for water. However, the analysis of the generalized linear models showed us that none of the main factors have significant effects on the disease burden (number of diseases) in each holding.

The objective of this study was to have an overview of the pathology encountered in sheep in the commune of Analavory. An analytical study of larger numbers would probably bring more interesting results, with sufficient statistical power to obtain significant results. In any case, the habits of farmers on the management of the breeding would have to be improved in order to reduce morbidity and to make the most of the potentiality of sheep. In future work, it would be interesting to improve this approach and add an economic (cost/benefit) approach.

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7. ADDITIONAL MATERIAL

Table -1 : Analysis results

Main factors	Main pathologies	Chi-square tests		
		χ^2	ddl	p
Type of sheepfold	EP/VB	0,652	1	0,419
	Foot rot	0,81	1	0,368
	Scabies	7,873	1	0,005
	Ringworm	1,826	1	0,177
	Phtiriosis	0,186	1	0,666
Aeration of sheepfold	EP/VB	0,198	1	0,338
	Foot rot	0,524	1	0,469
	Scabies	4,802	1	0,028
	Ringworm	0,286	1	0,593
	Phtiriosis	0,018	1	0,894
Respect for the sheepfold	EP/VB	10,714	1	0,001
	Foot rot	1,33	1	0,249
	Scabies	0	1	1
	Ringworm	0,048	1	0,827
	Phtiriosis	0,667	1	0,414
Dietary supplement	EP/VB	0,089	1	0,765
	Foot rot	1,833	1	0,176
	Scabies	0,139	1	0,709
	Ringworm	1	1	0,317
	Phtiriosis	2,222	1	0,136
Source of drinking water	EP/VB	0,33	1	0,566
	Foot rot	0,632	1	0,427
	Scabies	2,596	1	0,107
	Ringworm	3,692	1	0,055
	Phtiriosis	8,205	1	0,004
Cleaning frequency	EP/VB	1,429	1	0,232
	Foot rot	0,814	1	0,367
	Scabies	2,222	1	0,136
	Ringworm	1	1	0,317
	Phtiriosis	0,988	1	0,32
Deworming practice	EP/VB	0,01	1	0,822
	Foot rot	0,002	1	0,961
	Scabies	8,571	1	0,003

	Ringworm	1,714	1	0,19
	Phtiriosis	0,536	1	0,464
Mixed herd	EP/VB	6,467	1	0,011
	Foot rot	0,039	1	0,844
	Scabies	0,536	1	0,464
	Ringworm	0,429	1	0,513
	Phtiriosis	0,238	1	0,626

Source	**Model effects tests**		
	Chi-square of Wald	ddl	p
Constant	1.092	1	0.296
Mixed herd	0.169	1	0.681
Dietary supplement	0.005	1	0.945
Source of drinking water	1,734	1	0.188
Cleaning frequency	0.523	1	0.469
Practice of deworming	0.734	1	0.392
Herd size	1,886	1	0.170
Operating time	0.134	1	0.714

Composite test		
Likelihood ratio chi-square	ddl	p
6.346	7	0.500