International Journal of Veterinary Science

www.ijvets.com P-ISSN: 2304-3075 E-ISSN: 2305-4360 editor@ijvets.com

RESEARCH ARTICLE

Survey of Health Status of Domestic Rabbits in Selected Organized Farms in Kenya

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ARTICLE INFO

Received: October 02, 2014
Revised: October 16, 2014
Accepted: November 04, 2014

Key words:
Coccidiosis
Mange
Mucoid enteropathy
Rabbit diseases
Sore hock

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ABSTRACT

Rabbit has emerged as a key livestock that is increasingly being raised by farmers in Kenya. However, diseases and inadequate technical knowledge amongst animal health providers on these diseases are the major challenges facing the sustainability of rabbit farming in Kenya. This study was designed to determine the prevalence, etiology and clinical presentation of diseases of domestic rabbits with an aim of enhancing their diagnosis and management in the field situation. The cross sectional survey was conducted in 61 farms in rabbit producing areas in Kenya. Direct observational assessment and structured questionnaires were used to determine husbandry practices and health status in the farms. A total of 61 live rabbits, 320 bacteriological swabs, 363 fecal samples, and 21skin scrapings were collected from randomly selected rabbits and examined for etiological agents of disease in the laboratory. The frequently reported signs of diseases in rabbits were; diarrhea (81.97%), sudden death (73.78%) and bloat (68.85%). Ear canker (16.39), diarrhea (11.48%) and pneumonia (11.48%) were encountered during clinical examination. During necropsy digestive conditions (65.57%) including; intestinal coccidiosis (29.5%), hepatic coccidiosis (11.48%) and pinworms (3.28%) were commonly encountered. Clinical and sub clinical diseases affecting the digestive system are a major constraint to domestic rabbit production in Kenya. It is therefore recommended that animal health services providers participate actively in management of these diseases of rabbits.

Cite This Article as: PO Okumu, PK Gathumbi, DN Karanja, LC Bebora, JD Mande, JK Serem, MM Wanyoike, C Gachuiri, RN Mwanza and SK Mailu, 2015. Survey of health status of domestic rabbits in selected organized farms in Kenya. Inter J Vet Sci, 4(1): 15-21. www.ijvets.com

INTRODUCTION

Farmers in Kenya have shown great interest in domestic rabbit production over the years (Hungu *et al*., 2013). Rabbit has emerged as a key livestock that is increasingly being adopted and raised by small scale farmers in many parts of the country. This has been attributed to the active promotion of rabbit production by the government (Borter and Mwanza 2011; APD, 2010, Serem *et al.*, 2013). However, mortalities and morbidities in rabbits due to diseases are the major challenges facing rabbit farming in Kenya (Hungu *et al.*, 2013; Mailu *et al.*, 2012; Serem *et al.*, 2013). Limited knowledge on rabbit husbandry amongst farmers is another challenge to improved rabbit production (Mailu *et al.*, 2012; Serem *et al.*, 2013).

Diseases of rabbits are caused by known agents including bacteria, parasites, protozoa, fungi, viruses, genetics and nutritional deficiencies. However, miscellaneous causes comprising of physical and chemicals agents such as trauma, cold, heat and toxins (Martino and Luzi, 2008: Percy and Barthhold, 2008) have also been reported to cause diseases in rabbits.

In Kenya, many disease outbreaks in domestic rabbits have informally been reported by farmers who have suffered heavy losses due to mass deaths of rabbits from unconfirmed diseases (Borter and Mwanza, 2011). Diseases in rabbits have decimated whole stock and discouraged farmers from the rabbit enterprise while a few cases of human deaths have also been reported after consumption of sick rabbits (Gitonga, 2012). Despite these, systematic research in rabbit production and health

in Kenya is still scant since emphasis is laid on other food animals (Ngatia *et al.,* 1988). The inadequate laboratory facilities and the inadequate technical knowledge amongst animal health service providers on rabbit diseases further poses a challenge in confirmation of diseases encountered in the field outbreaks (Borter and Mwanza, 2011).This survey was designed to determine the health status of domestic rabbits in the main rabbit producing regions in Kenya, the etiological agents causing these diseases and clinical presentations of the diseases. This data will be useful to animal health service providers and farmers in such areas in the management of these diseases.

MATERIALS AND METHODS

Study area

This cross sectional survey was done in the main rabbit producing regions in Kenya (Borter & Mwanza 2011; MOLD 2010; Serem *et al.,* 2013). These areas included; Nairobi county and its surrounding areas of Karen, Ngong', Dagoretti, Ongata Rongai; Kiambu County (Thika town, Kabete and kikuyu); Nyeri County (Nyeri town, Othaya, Mukurweini and karatina): Meru County (Cenral Imenti, South Imenti); Nakuru county (Nakuru and Gilgil) and Taita –Taveta county (Wundanyi and Taita) respectively.

Study design and population

Rabbit farms visited were randomly selected from the lists of rabbit keepers obtained from the Department of Livestock production offices in the Ministry of Livestock Development in each county. Eighty percent of all the registered rabbit farms from each location were randomly selected from the list of rabbit keepers.

Clinical examination

In each farm, 80% of the rabbits (bucks, does and weaned kits) were randomly selected, physically restrained on a non-slip table surface and examined (Malley 2007). The following parameters were obtained and recorded during examination; body condition, skin and fur quality, faecal characteristics, presence of discharges and demeanor of the rabbits. The rabbit which clinically showed any abnormalities were isolated for sample collection depending on the clinical findings. Structured questionnaires were used to assess farm husbandry practices and the disease symptoms previously encountered in each farm and control measures undertaken.

Sample collection and analysis

The samples collected from the farms were; Microbiology swabs, skin and hair scrapings, feces, blood smears and live rabbits for necropsy. Each of these were identified and labeled with the background information in the farm, age, sex, breed and farm of origin. All the selected samples were transported to the department of veterinary Pathology, Microbiology and Parasitology at University of Nairobi for analysis.

Bacteriological swabs

Conjuctival and nasopharyngeal swabs were routinely collected from any rabbit selected randomly from the apparently healthy rabbits while other swabs were collected from rabbits showing clinical signs including; abscesses, ocular discharges and infected wounds. All swabs were transported to the laboratory in corked Bijou bottle with Stuarts transport media. The samples were submitted for bacteriological examinations using the standard protocols for bacteriology as described by Carter (1979).

Skin and hair scrapings

Superficial and deep hair scrapings were scrapping were collected using sharp surgical blades from skin lesions comprising of; alopecia, localized erythema, ear scab or crusts. The scrapings were submitted for fungal culture and identification in *Sabouraud Dextrose Agar* (Carter 1979) and/or parasite isolation. Parasite isolation was done through direct microscopy and following digestion in 10% potassium hydroxide as described by Soulsby (2005).

Fecal material

In each farm, 5 fecal samples comprising 25 g of fresh feces each were picked randomly from the litter and under the cages. Where rabbits were housed in groups, samples were collected from different areas of the cage(s) (Cerioli *et al.,* 2008). The samples were stored in plastic fecal pots and refrigerated at 4ºC until examined to determine number of coccidia oocysts and nematode eggs per gram of feces using McMaster Technique as described by MAFF (1986). Helminthes were recovered and preserved in 70% ethanol and identified using morphological characteristics according to Soulsby, (2005).

Live rabbits

The selected rabbits were then euthanized humanely for post mortem examination by intraperitonial injection of Sodium Pentobarbitone (Euthasol®, Virbac AH, Inc. Texas) at 100mg/kg body weight. Necropsies were performed and tissue samples were collected from all organs showing lesions for histopathology, bacteriology and parasitology. These included the liver, lungs, kidney, spleen, heart and any other organ with lesion. The samples for histopathology were preserved in 10% buffered formalin and routinely processed for histopathology examination as described by Kiernan (1981).

Statistical analysis

The Statistical Analytical System SAS V9 (SAS Institute Inc, 2002) was used for data analysis. Descriptive statistics such as means and frequency tables were used to show the health status of rabbit in the different regions.

RESULTS

A total of 2680 rabbits were examined within the 61 registered rabbit farms that were visited during the study. Nyeri, Nairobi and Kiambu counties had the highest average numbers of rabbits kept in each farm. The samples collected from the farms are as shown in Table 1.

Clinical signs

Majority 81.97% (50) farms reported to have encountered signs indicative of diseases previously.

Table 1: The average number of rabbits kept per farm in each county and samples collected from the farms

County	Farms visited	Average number of rabbits/ farm ± SD	Fecal samples collected	Rabbits for necropsy	Bacteriological swabs	Skin and hair scrapings	Blood samples
Kiambu	17	59.24±50.43	84	17	71	6	17
Meru	6	48.00±41.55	30	6	21	3	6
Nakuru	12	34.78±26.36	60	12	48	8	12
Nairobi	13	59.92±43.79	65	13	55	7	13
Nyeri	7	61.86±49.83	35	7	29	3	7
Taita-Taveta	6	24.17±13.50	28	6	26	4	6
Total	61	2680	302	61	250	31	61

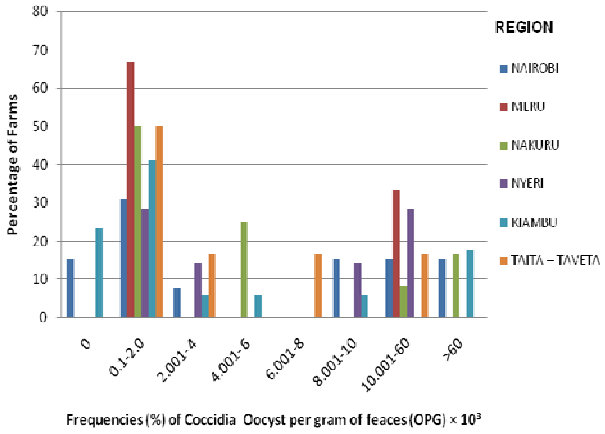

Fig. 1: Coccidia opg from rabbit farms from the selected study sites in Kenya within the period January 2012 – May 2013.

Diarrhea, sudden death and abdominal distension were the frequently reported clinical signs in 81.97% (50), 73.78% (45) and 68.85% (42) farms respectively. Clinical examination of rabbits frequently revealed ear scabs and crusts, rough hair coat and soiled perineum/diarrhea. Skin conditions were frequently diagnosed from these rabbits. These included; Localized mange, generalized mange, abscesses, traumatic wounds, dermatophytosis and flea infestation in 45.9% (28) farms (Table 2). Miscellaneous conditions including cage barbering, cannibalism and congenital splay leg were occasionally encountered in 6.56% (4) farms.

Etiological agents of diseases

A total of 85.1% (257) fecal samples from all the counties were positive for coccidia oocysts per gram of feces (opg) ranging between 1.0 -60 × 10^3 opg (Figure 1). A total 1.99% (6) of the fecal samples were positive for pin worm (*Passalurus ambiguous*) eggs per gram of feces (epg) ranging between 100 - 6000 epg.

Post mortem examination of the 61 rabbits revealed digestive tract diseases 65.57% (40) as a major clinical and subclinical cause of rabbit mortalities and morbidities. However these digestive diseases also occurred concurrently with others in several rabbits 85.25% (52). Enteritis 29.51% (18) due to intestinal coccidiosis 83.33% (15/18) was a major cause of mortalities in young rabbits aged (between 4 and 15 weeks). Hepatic coccidiosis 11.48% (7) in 6.56% (4) rabbits presented with unthriftness and emaciation. In 8.20% (5) rabbits diagnosed with mucoid enteropathy, bloating and enteritis were observed in 3 rabbits while coccidia counts of greater than 60 × 10^3 opg were isolated from the intestinal content of 4 rabbits.

Sneezing and purulent nasal discharges was observed in all the nine flocks from which rabbits with pneumonia 14.8% (9) were sampled from. Three of the five rabbits diagnosed with Sore hock were breeding does females more than 1year old. One of these rabbits also had urinary incontinence, arthritis and osteomyelitis.

Non-Pathogenic *Staphylococcus*, *Escherichia coli* and *Staphylococcus aureus* were frequently isolated from conjuctival and nasopharyngeal swabs. No bacteria were isolated in 4.17% (5) and 8.33% (10) of the conjuctival and nasopharyngeal swabs respectively. *Beta hemolytic Streptococcus spps* (8/10), *Staphylococcus aureus* (6/10), *Proteus mirabilis* in (3/10), *Pseudomonas aeroginosa* and *Corynaebacterium renale* (3/10) were frequently isolated from the ten swabs from the abscesses of rabbits with Sub-mandible, subcutaneous and retrobulbar abscesses (Table 4). The study did not reveal any haemo parasites in the blood smears.

DISCUSSION

Farmers from high potential areas (Mutugi, 2004) including; Nairobi, Nyeri, Kiambu and Meru kept more rabbits. Farmers in these areas usually have small land sizes, this finding supports that recent studies by Hungu *et al.*, (2013) and Serem *et al.*, (2013). This can be due to the fact that rabbit keeping require less space as compared to other agricultural activities ((Lukefahr and Cheeke, 1990).

Diarrhea and mortality of rabbits without showing any clinical signs are the major disease challenges in the rabbit farms, supporting a study by Aleri *et al.*, (2012) and other studies by Marlier *et al.*, (2003), Patton *et al.*, (2008) and Rosell and De la Fuente (2009). At necropsy enteritis and diarrhea was encountered in rabbits diagnosed with Intestinal and hepatic coccidiosis (P = 0.0425). Isolation of high quantities of coccidia (>4000 opg) in more than 40.98% (25) farms suggest coccidiosis as a common cause of diarrhea. Intestinal volvulus and intussusceptions observed in this study could be a sequel to intestinal hyperperistalsis due to intestinal coccidiosis (Weisbroth and Scher, 1975). Necropsy revealed constipation in one rabbit which was heavily affected with pinworms despite these worms being considered less pathogenic in rabbits (Rinaldi *et al.*, 2010; Lords, 2012). High mortality rates (33.33% to75% within a period of 1 week) were reported in farms from which mucoid enteropathy/ Enzootic rabbit enteropathy were diagnosed in rabbits, making mucoid enteropathy a major cause of mortality in rabbit farms in Kenya. Higher mortality rates have been reported in other studies (Licois *et al.*, 2005). However, Since Mucoid enteropathy also presented with death, bloating and

Table 2: clinical signs reported during the survey and the associated disease diagnosed

Clinical signs	Number of farms affected during clinical examination (%)	Number of farms affected previously as reported by farmers (%)	Diseases diagnosed
Ear scabs and crusts	10 (16.39)	35 (60.34)	Ear canker
Rough hair coat/ Depressed	8 (13.11)	7 (12.07)	Enteritis, Helminthes
soiled perineum/Diarrhea	7 (11.48)	50 (86.21)	Coccidiosis, Mucoid enteropathy
Sneezing/coughing/	7 (11.48)	24 (41.37)	Pneumonia
Eye discharges	6 (9.84)	7 (12.07)	Conjunctivitis, staphylococcosis
Localized erythema/alopecia	6 (9.84)	38 (65.52)	Mange mites, dermatophytosis
Found dead	5 (8.20)	45 (77.59)	Pneumonia, bloat, coccidiosis
Paw ulceration/sore hock	5 (8.20)	4 (6.90)	Sore hock, trauma
Scratching	5 (8.20)	17 (29.31)	Mange, fleas
Abdominal distension/Bloat	3 (4.92)	42 (72.41)	Mucoid enteropathy, Coccidiosis
Unthrifteness	6 (9.84)	8 (13.79)	**
Skin swellings	4 (6.56)	-	Abscesess, Fight wounds
Head tilting	4 (6.56)	-	Ear canker, Otitis externa
Ear discharges	2 (3.28)	-	Otitis externa
Hind limbs/paralysis	2 (3.28)	6 (10.34)	Splay leg, coccidiosis

Table 3: Diseases encountered during necropsy of the 61 rabbits and the etiological agents identified during the study

Body system affected	Disease diagnosed	No. of rabbits affected during post mortem examination	Causative agents isolated/ identified
Digestive	Enteritis	18	Intestinal coccidiosis from Eimeria spps, *
	Hepatic coccidiosis	7	*Eimeria stiedae*
	Mucoid enteropathy	5	Intestinal coccidiosis from Eimeria spps, *
	Bloat	3	Coccidia Eimeria spps, mucoid enteropathy
	Helminthiasis	2	Pinworms (*Passalurus ambiguus*)
	Constipation	1	Pinworms (*Passalurus ambiguus*)
	Intususception	1	Intestinal coccidiosis from Eimeria spps
	Gasteritis	1	**
	Peritonitis	1	*Pasteurella multocida*
	Volvulus	1	Intestinal coccidiosis due to Eimeria spps
Total		40	
Skin	Generalised alopecia	5	**
	Sub-mandible abscess	3	*Pseudomonas aerogenosa*, *Staphylococcus aureus*, *Proteus Mirabilis* and *Streptococcus spps*
	Mange around eyes	2	*Sarcoptes scabiei* mites
	Flea infestation	2	Dog flea (*Ctenocephalides canis*)
	Dermatophytosis	2	*Microsporum canis*
	Mange around nose	1	*Sarcoptes scabiei* mites
	Traumatic wound	1	Fights
	Subcutaneous abscess	1	Infected Traumatic wounds with *Staphylococcus aureus* and *Streptococcus spps*
Total		17	
Ears& eyes	Ear canker	6	*Psorotes cuniculi*
	Conjunctivitis	5	*Staphylococus aureus*, *Pasteurella multocida*
	Otitis externa	4	Infected ear canker with *Staphylococcus aureus*, *Escherichia coli*, *Proteus mirabilis* and *Klebsiella pneumonia*
	Retrobulbar abscess	1	*Staphylococus aureus*, *Pseudomonas aerogenosa*, *Escherichia coli*
Total		16	
Respiratory	Pneumonia	9	*Pasteurella multocida*, *Pseudomonas aerogenosa*, *Staphylococus aureus* and *Klebsiella pneumonia*
Total		9	
Miscellaneous	Emaciation	9	**
	Nephritis	1	*Staphylococcus aureus*
	septiceamia	1	*Pasteurella multocida*
	Trichophagy	1	**
	Cannibalsism	1	**
	Urinary incontinence	1	**
Total		14	

Where * means study did not isolate the shown agent from at least one rabbit; ** No specific etiological agent was isolated/ identified for shown disease.

matting of perineum due to copious gelatinous mucous plugs formed within the intestinal tract, the prevalence of this condition is probably higher than reported in this study. Recent studies (Licois *et al*., 2005; Marlier *et al*., 2003) suggest *clostridium perfringes* as the likely etiology of mucoid enteropathy. However the role of feed quality (Boisot *et al*., 2003), genetic selection (De Rochambeau *et al*., 2006), antibiotic prophylaxis (Badiola *et* al., 2000;

Table 4: Bacteria isolated from swabs collected from domestic rabbits during the study

Bacteria isolated	Frequency of isolation				
	Conjuctival swabs	nasopharyngeal swabs	Tissues(lung, liver, spleen)	abscesses	Infected wound swabs
E.coli	42	58	15	7	1
Non-Pathogenic *Staphylococcus*	59	65	21	-	-
Streptococcus spps	32	36	13	8	2
Micrococcus	13	26	14	-	-
Staphylococcus aureus	28	36	15	6	2
Enterobacter spps	2	2	6	-	-
Bacillus spps	1	2	6	-	-
Proteus mirabilis	1	-	-	-	-
Pasteurella multocida	1	3	3	3	-
Bordetella bronchiseptica	1	5	1	-	-
Klebsiella pneumoniae	2	1	3	-	1
Pseudomonas aeroginosa	1	-	3	3	1
Corynaebacterium renale	-	2	-	1	-
Citrobacter spps	-	1	3	-	-
No growth	5	10	1	-	-

Licois *et al*., 2005) and concurrent infection with opportunistic agents including coccidia in the pathogenesis of mucoid enteropathy should be investigated in a field situation.

Ear canker and Sarcoptic mange are common skin conditions of rabbits in Kenya (Aleri *et al.,* 2012). This can be attributed to the tropical climate (EFSA, 2005). Even though the two conditions rarely cause mortality in rabbits, other studies have reported weight loss (Eshar, 2010; Scott 2011) and secondary bacterial infections of the ears (Aiello *et al.,* 1998; Ulutas *et al.,* 2005) consistent with those observed in this study. The affected farms reported neither to control parasites nor treat the rabbits when affected. Previous studies report treatment of rabbits with ivermectin solution to be both curative and prophylactic for mite infestation (Aleri *et al*., 2012; Kyung Yeon & Oh Deog, 2010). The study did not recover any agent from skin scrapings collected from five rabbits that showed generalized alopecia on the dorsum and ventrums. However such lesions have been associated with fur mites (*Cheyletiella parasitivorax*) infestation (Kim *et al.,* 2008; Paterson, 2006).

Majority of these bacteria isolated from the conjunctiva and nasopharyngeal swabs have been reported as "Normal Flora" of the rabbit. However, these past studies (Cooper *et al.,* 2001; Cucarella *et al.,* 2004; Okerman *et al.,* 1984; Okuda and Campbell, 1974) reported lower frequencies of isolation compared to the present study. Isolation of pure cultures of these bacteria from sick rabbits suggests the opportunistic and pathogenic potentials of these organisms. Bacteria are considered major risk factors for diseases of respiratory system (Selva *et al*., 2008), skin (Corpa *et al.,* 2010), the eye (Hinton, 1977) and other septicemia in rabbits (Corpa *et al.,* 2010; Cucarella *et al.*,2004) as seen in this study. Bacterial infection following ulceration of paws and urine burns (Blair, 2013; Corpa *et al.,* 2010) was the likely cause to Sore hocks/chronic ulcerative pododermatitis and arthritis and osteomyelitis encountered in this study. Wire mesh floors commonly used in the hutches could have also attributed to sore hock (Mirabito 2003; Rosell and De la Fuente, 2009; Rosell and Fernando 2013; Sánchez *et al.,* 2012).

Cannibalism and trichophagy have been associated with diet that is inadequate in quality and quantity, injury or abnormality in kits, disturbance of the doe following kindling (Patton *et al.,* 2008) and abnormal maternal behaviors in rabbits (González and Zamora, 2008), the present study could not ascertain the cause of these cases. Emaciation and unthriftiness encountered in this study can be attributed to underlying diseases (Rosell and De La Fuente, 2008) common in these rabbits.

Clinical and sub clinical diseases affecting the digestive system are a major constraint to domestic rabbit production in Kenya. It is therefore recommended that animal health services providers participate actively in management of these diseases of rabbits. It is also advised that the regional Veterinary diagnostic laboratories be used for surveillance of rabbit disease outbreaks so as to inform on the rabbit disease incidences and prevalence in time and space and facilitate informed disease diagnosis, treatment and control.

Acknowledgement

The authors wish to thank, the national commission for science technology and innovation (NACOSTI) and the Ministry of Livestock development for their facilitation during the sample collection and farm visits. All farmers who participated in this study and members of staff of the Faculty of Veterinary Medicine, University of Nairobi are highly appreciated.

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