

A Survey of Disease Occurrence in Korean Black Goats

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Abstract : The goat industry has been developing for many years in Korea to meet demands for food and medicine. However, many complicated patterns of disease have arisen in goat farms as this industry has developed. In this study, disease occurrence patterns in Korean black goats were surveyed in six professional farming households in Imsil and Soonchang in the Jeonbuk province and in Hamyang and Sachon in the Gyeongnam province to understand and extend the goat disease database. We observed morbidity rates between 2.0% and 9.8% for adult goats and between 2.9% and 68.3% for kids. Kids showed a markedly higher incidence of disease when compared to adults. The rate of disease occurrence was 40.0% for floppy kid syndrome (FKS), 37.7% for diarrhea, 16.0% for respiratory disease, and 1.9% for skin disease. The observed mortality rates were 0.7% ~ 10.0%, and 2.2% ~ 24.9% for adult goats and kids, respectively. In addition, FKS, diarrhea, and respiratory disease were observed in 38.3%, 28.9%, and 10.0%, respectively, of dead goats. In conclusion, the majority of diseases in goats occur during the neonatal period, and FKS is the highest single cause of mortality in Korean black goats. Thus careful attention must be paid to kids to reduce the goat mortality rate.

Key words : goats, disease, floppy kid syndrome, mortality rate.

Introduction

Worldwidely, 599 species of goats (including 512 native species) and 786 million goats are being raised (FAO, 2005). Goats have long been raised as a domestic stock in Korea. The consumption of Korean black goat meat, which has traditionally been eaten as a health food, has increased significantly during recent years because of the increased consumer demand for livestock products. In order to meet the growing demand for goat meat, goat-raising operations have become larger and more specialized. The statistics in 2008 from the Ministry for Food, Agriculture, Forestry, and Fisheries show that 20,534 farm households have raised 266,240 head of black goat in Korea. The incidence of disease in Korean black goats has increased as their rearing environments have been converted into mass rearing operations. This increased disease incidence leads to decreased productivity in farming households. However, little is known regarding the specific patterns of disease occurrence in Korean black goats.

The major causes of mortality in goats, regardless of age, have been reported to be gastrointestinal and respiratory diseases (1,2). Hariharan *et al.* (6) performed bacterial and viral

studies to identify the causes of diarrhea in goats and isolated *Escherichia fergusonii* from goat feces. Nelson *et al.* (12) identified bovine viral diarrhea virus in goats. In addition, floppy kid syndrome (FKS), which is one of the most problematic diseases in goats, was identified in newborn goats (16,17). Recent studies have also been conducted to determine the causative agents and the infection rates of internal parasites in Korean black goats (7,13,14). Son *et al.* (20) examined the dependence of disease occurrence patterns by the raising scale, raising type, and growth stage of goats.

The current study was performed to analyze the patterns of disease occurrence observed in professional farming households that goats. This study attempts to establish baseline data for the prevention of disease in Korean black goats.

Materials and Methods

Farming households

In the present study, the patterns of disease occurrence and mortality were examined in six professional farming households for Korean black goats in Imsil and Soonchang in the Jeonbuk province and Hamyang and Sachon in the Gyeongnam province. The farming households examined here raise 300~500 black goats and produce 300~450 kids annually (Table 1).

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Table 1. The number of goats in each age group at each farm

Farm	No. of goats according to age			Total
	Adult	Growing	Kid	
A	250	150	390	790
B	300	120	440	860
C	256	62	456	774
D	152	118	360	630
E	200	100	490	790
F	150	180	510	840
Total	1,308	730	2,646	4,684

Survey of diseases

We visited six farming households and carried out surveys investigating the patterns of disease occurrence and mortality in Korean black goats in each farming household according to their raising stage and age. The incidence of disease was investigated by a veterinarian weekly.

The morbidity and mortality rates were calculated as the number of events (disease and death) divided by the number of black goats raised in 2009.

Diagnosis of diseases

Disease diagnoses in goats were performed in compliance with the ethical guidelines of the animal welfare committee of the National Institute of Animal Science. Goats were classified as adult (over 12 months of age), growing (between 4 and 12 months of age), or kids (younger than 4 months) according to their age.

Based on clinical signs observed by farmers participating in this study, disease in black goat was classified (Table 2).

Case of floppy kid syndrome was defined as kids appeared normal at birth but developed a sudden onset of profound mus-

Table 2. Classification of diseases in black goat

Type of diseases	Clinical sign	Reference
FKS	Decreased muscle tone, apathy	3
Diarrhea	Watery or yellowish feces	2
Respiratory	Cough, nasal discharge	2
Skin disease	Alopecia, itching	5
Arthritis	Lameness, edema of joint	18
Urolithiasis	Dysuria, prolonged urination	10
Waist paralysis	Lying on one's side	22
Abortion	Birth of dead kid	1
Gestosis	Edema of whole body during pregnant	19
Cryptogenic	Not found special clinical sign	22
Mastitis	Edema of udder	9
Laminitis	Lameness and abscess of claw	11
Retained placenta	Not discharge of placenta	15
Premature birth	Birth of premature kid	4
Wound	Injured skin, pus	21

cular weakness between 3 and 15 days of age. Affected kids could not use their tongues to suckle and did not exhibit any signs of diarrhea, respiratory disease, or other signs that could be associated with a specific organ system. Urolithiasis was diagnosed by the symptoms of dysuria, prolonged urination, tail flagging, and abdominal pain. Other diseases were defined by the symptoms of sick goats.

Statistical Analysis

Data were subjected to an analysis of variance (ANOVA) procedure of Statistical Analysis Systems (SAS Institute, Cary, NC, USA) with post-hoc comparisons using the Duncan's multiple range tests. A $p < 0.05$ was considered to be significant.

Results

Disease occurrence in Korean black goats

The incidences and patterns of diseases in six farming households were shown in Table 3 and Table 4, respectively. The age-related disease incidence in these six households ranged from 2.0 to 9.8% in adult goats, from 2.0 to 53.2% in growing goats, and from 2.9 to 68.3% in kids (Table 3). The overall disease incidence was 5.0% in adult goats and 19.5% in kids. In addition, the disease incidence rates were significantly different among six farming households (Table 3, $p < 0.05$).

The overall incidence of FKS, which was the most commonly observed disease, was found to be 40.0% at these six farming households. The incidence of diarrhea, which was almost as common as FKS, was found to be 37.7%. Respiratory disease (16.0%), skin disease (1.9%), arthritis (0.6%), urolithiasis (0.6%), and waist paralysis (0.6%) followed diarrhea were also observed (Table 4).

Type of disease observed in dead Korean black goats

The age-related mortality and disease pattern observed in dead goats were examined at each of the six farming households (Tables 5 and 6).

The observed age-related mortality ranged from 0.7% to

Table 3. Age-related disease morbidity in Korean black goats at each farm

Farm	Disease occurrence (%)			Total (%)
	Adult	Growing	Kid	
A	9 (3.6) ^b	36 (24.0) ^b	92 (23.6) ^b	137 (17.3) ^b
B	15 (5.0) ^b	25 (20.8) ^b	51 (11.6) ^c	91 (10.6) ^c
C	25 (9.8) ^a	33 (53.2) ^a	41 (9.0) ^d	99 (12.8) ^c
D	7 (4.6) ^b	6 (5.1) ^c	246 (68.3) ^a	259 (41.1) ^a
E	7 (3.5) ^b	2 (2.0) ^c	14 (2.9) ^e	23 (2.9) ^d
F	3 (2.0) ^b	4 (2.2) ^c	71 (13.9) ^c	78 (9.3) ^c
Total	66 (5.0)	106 (14.5)	515 (19.5)	687 (14.7)

^{a,b,c,d,e} Different superscripts in each column indicate significant difference ($P < 0.05$)

Table 4. Patterns of disease occurrence in Korean black goats

Type of diseases	No. of goats with disease	Disease (%)
Floppy kid syndrome	275	40.0
Diarrhea	259	37.7
Respiratory	110	16.0
Skin disease	13	1.9
Arthritis	4	1.9
Urolithiasis	4	1.9
Waist paralysis	4	1.9
Abortion	4	1.9
Gestosis	3	0.4
Cryptogenic	3	0.4
Mastitis	2	0.3
Laminitis	2	0.3
Retention of placenta	2	0.3
Premature birth	1	0.1
Wound	1	0.1
Total	687	100.0

Table 5. Mortality rates goats of different ages at participating farms

Farm	Dead goats (%)			Total (%)
	Adult	Growing	Kid	
A	12 (4.8) ^b	13 (8.7) ^{ab}	97(24.9) ^a	122 (15.4) ^a
B	5 (1.7) ^b	13 (10.8) ^a	38 (8.6) ^c	56 (6.5) ^c
C	2 (0.8) ^c	4 (6.5) ^{abc}	10 (2.2) ^e	16 (2.1) ^d
D	2 (1.3) ^b	2 (1.7) ^c	66 (18.3) ^b	70 (11.1) ^b
E	20 (10.0) ^a	3 (3.0) ^{bc}	32 (6.6) ^{cd}	55 (7.0) ^c
F	1 (0.7) ^c	2 (1.1) ^c	17 (3.3) ^{de}	20 (2.4) ^d
Total	42 (3.2)	37 (5.1)	260 (9.8)	339 (7.2)

^{a,b,c,d,e}Different superscripts in each column indicate significant difference ($P < 0.05$)

10.0% in adult goats, from 1.1 to 10.8% in growing goats, and from 2.2% to 24.9% in kids (Table 5). The mortality was significantly different among six farming households ($p < 0.05$). The mortality of all farming households was averaged. The age-related mortalities were 3.2%, 5.1%, and 9.8% in adult goat, growing goat, and kids, respectively.

Disease patterns were investigated in dead goats based on clinical signs. FKS was found in 38% of dead goats. Diarrhea, respiratory disease, cryptogenic disease, and urolithiasis were followed as 28.9%, 10.0%, 6.2%, and 3.9%, respectively (Table 6).

Discussion

To our knowledge, this study is the first published report regarding the occurrence of FKS in Korean black goats. The results obtained here indicate that FKS is the disease with the

Table 6. Rate of disease observed in dead goats

Type of disease	No. of dead goats	Rate (%)
Floppy kid syndrome	130	38.3
Diarrhea	98	28.9
Respiratory	34	10.0
Cryptogenic	21	6.2
Urolithiasis	12	3.5
Weakness	10	2.9
Poor lactation	6	1.8
Skin disease	6	1.8
Uteritis	5	1.5
Gestosis	3	0.9
Waist paralysis	3	0.9
Bloat	2	0.6
Freeze to Death	2	0.6
Death from pressure	2	0.6
Mastitis	2	0.6
Liver rupture	1	0.3
Dystocia	1	0.3
Uterine prolapse	1	0.3
Total	339	100.0

highest single cause of in Korean black goats.

Disease occurrence and mortality are more common in young livestock than in older animals. The present study also showed that disease incidence and mortality are approximately four-fold and three-fold higher, respectively, in kids than in adult goats. These results are in agreement with previous studies that reported 14.4% mortality in adult goats and 41.4% in goats aged six months or younger (2). Traore and Wilson (22) have also reported an approximate three-fold increase in mortality in kids (35%) when compared to adult goats (12.7%). In addition, Ikwuegbu *et al.* (8) reported that cumulative mortality was found to be 9.2% in goats aged three months, 10.8% in those aged four months, 12.4% in those aged five months, and 14.5% in those aged 12 months. Overall, the mortality observed during the first year of accounted for 45% of total mortality.

In the present study, FKS had the highest incidence and mortality of all diseases found to occur in Korean black goats. Although numerous studies have examined potential causes and treatments of FKS, none of these studies have specifically investigated the incidence of FKS in Korea. Trembaly *et al.* (23) first reported on goats that presented with metabolic acidosis that was not accompanied by dehydration and diarrhea in Canada. Goats with FKS present no symptoms at birth, but these animals exhibit an abrupt decrease in muscle tone accompanied by anorexia and irresponsiveness between postnatal days 4 and 14. These animals are also characterized by metabolic acidosis (3). The morbidity and mortality of FKS in kids have been reported to be 10~50% (17) and 30~50% (16), respectively. This study also showed that FKS

accounted for 40.0% of the total disease incidence observed in goats in the six farming households examined here. FKS was also the highest single cause of mortality, accounting for 38.3% of the total number of goat deaths.

According to Ameh *et al.* (2) and Akhtar and Khan (1), the disease associated with the highest mortality in younger goats is diarrhea. In contrast, Traore and Wilson (22) reported that respiratory diseases were responsible for the highest mortality rates in goats. The current study found that both diarrhea and respiratory diseases were associated with high mortality in younger goats, but neither was as strongly associated mortality as FKS.

In conclusion, morbidity and mortality were both found to be markedly higher in kids than in adult goats. The most common diseases and causes of mortality included FKS, diarrhea, and respiratory diseases. Because of the high incidence of disease, especially FKS, professional farming households that raise black goats suffer significant economic losses. It is therefore imperative to improve the current methods for the prevention and management of diseases in black goats. To do so, further studies on the etiology, treatment, and prevention of FKS will be required.

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References

1. Akhtar S, Khan MQ. An on-farm health monitoring of small ruminants: design, and disease frequencies. *Rev Sci Tech* 1995; 14: 831-840.
2. Ameh JA, Egwu GO, Tijjani AN. Mortality in sahelian goats in Nigeria. *Prev Vet Med* 2000; 44: 107-111.
3. Bleul U, Schwantag S, Stocker H, Corboz L, Grimm F, Engels M, Borel N, Lutz H, Schonmann M, Kahn W. Floppy kid syndrome caused by D-lactic acidosis in goat kids. *J Vet Intern Med* 2006; 20: 1003-1008.
4. Buddle BM, Herceg M, Ralston MJ, Pulford HD, Mrlar KR, Elliott DC. A goat mortality study in the southern North Island. *N Z Vet J* 1988; 34: 167-170.
5. Eguchi-Coe Y, Valentine BA, Gorman E, Villarroel A. Putative *Malassezia dermatitis* in six goats. *Vet Dermatol* 2011; 22: 497-501
6. Hariharan H, Lopez A, Conboy G, Coles M, Muirhead T. Isolation of *Escherichia fergusonii* from the feces and internal organs of a goat with diarrhea. *Can Vet J* 2007; 48: 630-631.
7. Heo JH, Jung MH, Cho MH, Ahn DW, Lee SS. A survey on the actual management and the prevalence of internal parasite in the Korean indigenous goats of southern Kyoungnam area. *Korean J Vet Serv* 1999; 22: 71-77.
8. Ikwuegbu OA, Tarawali G, Rege JEO. Effects of fodder banks on growth and survival of west African dwarf goats under village conditions in sub-humid Nigeria. *Small Rumin Res* 1995; 17: 101-109.
9. Lasagno MC, Vissio C, Reinoso EB, Raspanti C, Yaciuk R, Larriestra AJ, Odierno LM. Development of an experimentally induced *Streptococcus uberis* subclinical mastitis in goats. *Vet Microbiol* 2012; 154:376-383.
10. Mavangira V, Cornish JM, Angelos JA. Effect of ammonium chloride supplementation on urine pH and urinary fractional excretion of electrolytes in goats. *J Am Vet Med Assoc* 2010; 237: 1299-1304.
11. Mgasa MN, Mbassa GK. Tolerance of goats to experimental grain engorgement and intraruminal lactic acid injection. *Vet Res Commun* 1988; 12: 143-147.
12. Nelson DD, Dark MJ, Bradway DS, Ridpath JF, Call N, Haruna J, Rurangirwa FR, Evermann JF. Evidence for persistent bovine viral diarrhea virus infection in a captive mountain goat (*Oreamnos americanus*). *J Vet Diagn Invest* 2008; 20: 752-759.
13. Park NC, Do JC, Kim SW, Song HB. A survey on the prevalence of internal parasites in the Korean indigenous goats of Kyungbuk area. *Korean J Vet Serv* 1997; 20: 349-358.
14. Park NC, Do JC, Kim SW, Song HB. Studies on the efficiency of anthelmintics to goats infected with internal parasites. *Korean J Vet Serv* 1998; 21: 439-449.
15. Probo M, Cairoli F, Kindahl H, Faustini M, Galeati G, Veronesi MC. Periparturient hormonal changes in Alpine goats: a comparison between physiological and pathological parturition. *Reprod Domest Anim* 2011; 46: 1004-1010.
16. Riet-Correa F, Tabosa I, Vasconcelos J. Syndrome do cabrito mole("floppy kid"). *Pesq Vet Bras* 2004; 24: 111-113.
17. Rowe J, East N. Floppy kid syndrome. *Dairy Goat J* 1996; 74: 350.
18. Sanchis R, Abadie G, Lambert M, Cabasse E, Dufour P, Guibert JM, Pepin M. Inoculation of lactating ewes by the intramammary route with *Mycoplasma agalactiae*: comparative pathogenicity of six field strains. *Vet Res* 2000; 31: 329-337.
19. Schroeck R, Heimisch W, Gebhardt K, Mendler N. Hyperoncotic hemodilution with human albumin (20%) as a new therapeutic procedure in EPH-gestosis. *Dev Biol Stand* 1980; 48:53-62.
20. Son DS, Choe CY, Choi SH, Cho SR, Kim HJ, Hur TY, Kang SJ, Ryu IS, Do YJ, Suh KH. The pattern of disease occurrence in its dependence on the growth stage in Korean Black goats. *J Anim Sci & Technol* 2008; PB28010 (abstract).
21. Stinner DJ, Waterman SM, Masini BD, Wenke JC. Silver dressings augment the ability of negative pressure wound therapy to reduce bacteria in a contaminated open fracture model. *J Trauma* 2011; 71: S147-150.
22. Traore A, Wilson RT. Livestock production in Central Mali: environmental and pathological factors affecting morbidity and mortality of ruminants in the agropastoral system. *Prev Vet Med* 1988; 6: 63-75.
23. Tremblay RRM, Butler DG, Allen JW, Hoffman AM. Metabolic acidosis without dehydration in seven goat kids. *Can Vet J* 1991; 32: 308-310.

흑염소 사육농가의 질병발생 실태조사

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요 약 : 우리나라에서 흑염소는 오랫동안 육용 및 약용으로 널리 사육되어 오고 있다. 흑염소 산업이 발달함에 따라 사육농가에서 복잡·다양한 질병이 발생되고 있는 형편이다. 본 연구에서는 전북 임실, 순창과 경남 함양, 사천에 소재한 6개 흑염소 전업농가를 대상으로 흑염소에서의 질병 발생 양상을 분석하고, 우리나라에서 흔들이병의 발생현황을 확인하였다. 질병의 발병율은 성축에서 2.0%~9.8%를 나타낸 반면, 자축에서는 2.9%~68.3%를 나타내어 어린 가축에서 높은 발병율을 나타내었다. 발생한 질병중 신생축의 대사성 산증에 의해 유발되는 흔들이병이 전체 발생질병 중 40.0%로 가장 높은 비율을 차지하였고, 다음으로 설사병 37.7%, 호흡기질환 16.0%, 피부질환 1.9%의 비율을 나타내었다. 질병에 의한 폐사율은 성축에서 0.7%~10.0%를 나타낸 반면, 자축에서 2.2%~24.9%로 성축에 비해 높은 폐사율을 나타내었으며, 질병별 폐사비율로는 흔들이병이 38.3%로 가장 높았으며, 이외 설사병 28.9%, 호흡기질환 10.0%를 나타내었다. 결론적으로, 우리나라에서 사육하는 흑염소에서 가장 많이 발생하고, 폐사되는 질병으로 신생자축의 흔들이병으로 조사되었는데, 이를 기반으로 흔들이병을 포함한 흑염소에서 발생하는 질병의 정확한 발생기전과 치료 및 예방대책에 대한 연구가 지속적으로 수행되어야 될 것으로 사료된다.

주요어 : 흑염소, 질병, 흔들이병, 폐사율