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Sığırlarda Böbrek Taşı Oluşumu ve Çeşitleri

Formation and Types of Kidney Stones in Cattle

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Öz

Kars' ta Kasım- Şubat 2021 ayları arasında mezbahanelerde kesimi yapılan 256 erkek ve 200 dişi sığır olmak üzere 456 sığır taş yönünden incelendi. Tüm böbreklerin 37'sinde (erkek:27, dişi:10) taş olgularına rastlandı. Taşlar, kimyasal yöntemlerle fosfat, kalsiyum, ürat, karbonat, kalsiyum okzalat, sistin, ksantin, magnezyum, amonyum ve silikat yönünden analizleri yapıldı. Erkek sığırlarda taş komposisyonları yönünde incelendiğinde %6,64 fosfat, %1,56 karbonat, %10,55 kalsiyum okzalat, %7,03 ürat, %0,78 sistin, %1,56 amonyum, %1,56 magnezyum, %0,39 ksantin bileşikleri saptanırken, dişilerde bu oranlar sırasıyla %1,50 fosfat, %4,00 kalsiyum, %3,00 kalsiyum okzalat, %0,50 ürat, %1,50 amonyum, %0,50 magnezyum bulundu, ancak öte yandan silikat, ksantin, sistin ve karbonat görülmedi.

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Abstract

In this study, 456 cattle, 256 male and 200 female, slaughtered in slaughterhouses in Kars region between November and February 2021 were examined for kidney stones. A total of 37 stones were detected in all examined kidneys (male:27, female:10). The stones obtained were chemically analyzed in terms of phosphate, calcium, urate, carbonate, calcium oxalate, cystine, xanthine, magnesium, ammonium and silicate compositions. There were achieved 6.64% phosphate, 1.56% carbonate, 10.55% calcium oxalate, 7.03% urate, 0.78% cystine, 1.56% ammonium, 1.56% magnesium and 0.39 xanthine compound in male cattle. Female kidney stone examination showed that their structure consist 1.50% phosphate, 4.00% calcium, 3.00% calcium oxalate, 0.50% urate, 1.50% ammonium and 0.50% magnesium. Interestingly that such compounds like silicate, xanthine, cystine and carbonate were not observed in female kidney stone.

1. INTRODUCTION

Agriculture and animal husbandry in the changing the world in parallel with technology and population growth; due to the decreasing food resources, it has become a sector that is increasingly sought and should be given importance. In addition, it has undertaken functions such as providing national development, providing employment to the industry and service

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sector, and correct and balanced nutrition. However, Kars, which has 3.2% of the cattle in Turkey and 39.2% of its land is covered with meadow-pasture, has not been able to provide the necessary existence for various reasons, although there is an important potential for livestock (Aral, 1996). One of these reasons is lack of care and nutrition, insufficient quality of pastureland and kidney and urinary stone formation caused by their contents. Urolithiasis is a disease of intact and castrated male ruminants (sheep, cattle, and goats) and pigs. Uroliths are solid aggregates of minerals that precipitate out of the fluid phase of urine to form one or more pebble-like stones in the urinary tract. Urinary system stone disease (USTH) is a common systemic disease and can cause both acute and chronic kidney damage. Kidney stone formation is defined as crystal nucleation, growth, aggregation and crystal retention within the renal tubular (Kok et al.,1994; Pak,1991; Çakır eta l.,2014). The formed crystal begins to nidus when appropriate conditions are met. Today, the absence of a pharmacological treatment option that can cure or prevent this disease and the ten year recurrence rate reaching 50% maket he picture even more chronic (Forman et ak.,1959; Winneir et al.,2010).

Stone formation is a phenomenon encountered in all ages and animals of all breeds. The formation of the stone begins with a nidus. Cell debris, necrotic tissues, and crystalline substances are substances that play a rol in the formation (Winneir et al.,2010). Their chemical and physical structures, sizes and shapes are different. The main inorganic compounds found in these stones are calcium carbonate, calcium phosphate, silicate, oxalate and urates At the same times, together with the pH factor, it may affect the formation of stones in the mineral structure of the diet and drinking water (Gasthuys et al.,1993; Balley et al.,1963).

The urinary system starts with the kidney and varies between the species and breeds of the animal (Makhdoomi & Gazi, 1913). Anatomically, right kidney in ruminants between 13rd-costa and 2rd-3rd the lumbar vertebrae, the left kidny is pulled into the caudala. Urine flows from the ureter into the urine. The females are also straight, and the flexura sigmioidea is folded with a long narrow urethra channel in males and is ejected by the orificium urethra external (Yüksel and Yaman, 2008; Makhdoomi and Gazi, 2013; Anjara,1967). Kidney stone formation is a complex process that includes the concentration of stone-forming ions, urine pH and flow rate, anaomical abnormalities that may cause urinary stasis, and varieuus metabolic factors (Baştuğ, 2013).

Urolithiasis affects both sexes, but urinary blockade is major problem only in males. Urolithiasis is the retention of urine subsequent to lodgment of calculi anywhere in the urinary conduct from up to urethral orifice. The disease results in heavy economic losses to the livestock industry as it is attributed the fifth most prevalent cause of death in feedlot. Obstructive urolithiasis is a serious, potentially fatal condition, most commonly causing symptoms in castrated male animals, but also occurring in breeding males.

Ruminant urolithiasis is considered primarily as a nutritional disease. The composition of urolithis, also called urinary stones or stones, varies according to tha animal lives. The most common urolihtes are calcium apatite and phosphate based stones (for example, calcium hydrogen phosphate, calcium hydrogen phosphate dihydrate, and magnesium ammonium phosphate or struvite)(Kok and Khan 1994; Breslau et al., 1988). Although the animal is given abundant concentrate feed, giveng very little roughage, not using roughages, and long feding intervals can facilitate the formation of urinery stones.

Urethral obstruction caused by uroliths is most common in show or domestic goats and lambs with a high grain, low roughage diet. Diabets high in grain, phosphorus and magnesium and law in roughage (hay or fresh grass) and calcium will increase the risk of phosphate urolite formation(Güven et al., 2003). Normally, a ruminant removes phosphorus from their body by expelling it into salva and then through feces/dung). High-grain, low-roughage diets reduce saliva formation, so excess phosphorus must be removed from the blood by the kidneys and then excreted in the urine. Diets are too high in phosphorus, urine phosphorus settles and consolidates into stone-like pellets that can be too large to pass. These uroliths icrease the risk of urinary tract infections and can cause life-threatening obstruction of the urethra. Some sheep breeds (such as Texel and Scottish Blackface) may be prone to stone formation as they tend to excrete phosphorus from the urinary tract rather than saliva (Makhodoomi and Gazi, 2013; Güven et al., 2003; Maraşlı et al., 1993). Urolithiasis affects both sexes, but urinary blockade is a majör problem only in males. The intense stone formation in males is due to obstrictions in the flexira sigmoidea (S-fold) area in the breed(Pak, 1991, Çakır et al.,2014, Krzemien et al.,2016;Singh and Rai,2014). The aim of this study is to reval the biochemical and histopathological Picture of kidney Stones, which is a regional problem in czattle, in the Kars region, where animal husbandry is made, and to contribute to studies on the precautions to be taken.

2. MATERIAL VE METOD

The kidneys of 456 cattle (256 males and 200 famales) of various breeds slaughtered in Kars province slaughterhouse were examined for stone formation. Stone samples taken from 37 cattle with stone formation were examined physically and chemically. Recordings of the appearance, weight, color and hardness of the kidneys and stone taken. Systematic stone analysis method was used in the biochemical qualitative examination of stone (Ergun, 1078; Ersoy, 1981). The sones taken according to this method are grround and turned into power. It is defined between 2-30 in the analysis using chemical soutions for each parametrers. The Stones were examined in terms of calcium, phosphate, calcium carbonate, calcium oxalate, silicate, uric acid, systine, xanthine and ammonium.

3. RESULTS

3.1. Physical findings:

In terms of from and density of kidney stones in cattle, 456 cattle kidney stones, 256 males and 200 famales, were examined. The average weight of stone samples taken from 37 cattle with stone formation was 11-2080 mg, while their size was determined as 0,2-1.1 cm. While stone samples, which were generally in irregular shapes, formed hardnesses suitable for their components, their colors were white, white gray, yellowish white, and cream, depending on the density of stone formation and kidney degeneration, and generally showed a rough outer structure (Figure.1).

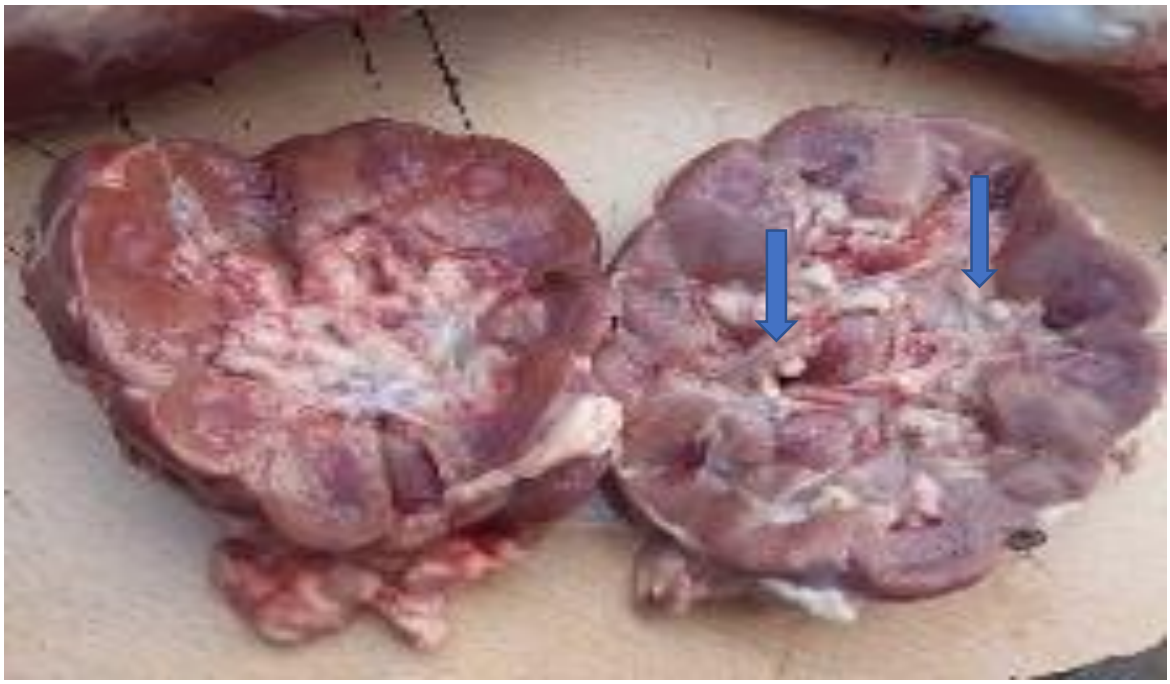

Figure:1 Cattle kidney stone formation examples

Figure:2 Cattle kidney stone formation examples

3.2. Chemical Findings:

The biochemical qualitative examination was used for the systematic stone analysis (Ersoy & Bayşu, 1981; Demir & Aral, 2009). The Stones were examined in terms of calcium, phosphate, calcium carbonate, calcium oxalate, silicate, uric acid, cystine, xanthine, and ammonium.

Table 1. Frequency of the chemical component from kidney stones

Cattle breed/ Parameters	Male	Female
Calcium	27	8
Phosphate	17	11
Calcium Carbonate	34	9
Calciumoxalate	18	7
Silicate	-	-
Urat	2	1
Xanthine	1	-
Cystine	2	-
Ammonium	4	3
Magnesium	4	1
Carbonate	3	0

Table 2. Percentage of kidney stones found (%)

Cattle breed/ Parameters	Male (n:256)	Female(n:200)
Calcium	10,55	4,00
Phosphate	6,64	5,50
Calcium Carbonate Phosphate	13,28	4,50
Calciumoxalate	7,03	3,50
Silicate	0,00	0,00
Urat	0,78	0,50
Xanthine	0,39	0,00
Cystine	0,78	0,00
Ammonium	1,56	1,50
Magnesium	1,56	0,50
Carbonate	1,17	0,00

Table 3. Percentages of chemical combinations in the constituent of kidney stone (%)

Cattle breed/ Parameters	Phosphate+carbonate	Carbonate+Calcium phosphate	Magnezium +amonium phosphate
Male(n:256)	20,00	47,00	25
Female(n:200)	11,00	19,00	15

4. DISCUSSION

Renal diseases in cattle are frequently not recognized due to the subclinical conditions. Uroluthiasis and nephrolithiasis pose major problems in terms of animal husbandry in the Worldwide and in our country. In addition to metabolic effects in the formation of uroliths, endocrinological, consititution, upper urinary tract infections, congenital alkyd malformations and feding patterns can be listed. It is known that chemicals in water and nutrients have important effects on the formation of uroliths. In addition to organic nutrients such as free fatty acids, fat cholesterol, carbohydrates and mucoproteins, organic compounds such as soric acid, sodium urate, potassium urate, cystine, carbonates, xanthine, homogenzitic acid, indigo are stated to be directly or indirectly effective in stone. Stone formation in animals are formed as a result of the combination of salts excreted in the urine with proteins of the precipitation of salts on this matrix after the development of an organic matrix, a dead cell remnant or a blood clot (Krzemien et al2016; Bauza et al., 2018). It has been reported that cases of urolithiasis are formed in the urinary system in the ureters % as it is knowen, ureter and bladder. Stones are shaped as secunder and the most important source of stone formation is the kidneys(Khan et al., 2016).

In this study, cattle were evaluated not only in terms of kidneys but also in terms of bladder and orinary tract. Analyzes of the 48 uroliths revealed that 20% were composed of carbonate+phosphate, 47% were calcium+carbonate+phosphate, 25% were magnezium+ammonium+ phosphate compound. In 1994, kidney stones were found in fattening and pasture cattle at a rate of 10,7% in beef cattle and 8% in pasture cattle in the same region (Maraşlı et al;1995). In the study conducted by Güven et al. (2003) in 807 sheep in Kars, Ardahan and Iğdır, stone cases were found in 45 of them. Compared to our study, it can be said that kidney stones are an increasing problem in animals(Güven et al,2003). In 1994, kidney stones were detected in fattening and pasture cattle at a rate of 10,7% in beef cattle and 8% in pasture cattle. In the study conducted by Güven et al., (2003) in 807 sheep in Kars, Ardahan ve Iğdır, stone cases were found in 45 of them. Compared to our study, it can be said that kidney stones are an increasing problem in animals (Maraşlı et al;1995). The other compound urolith was composed of a center of 90% calcium phosphate carbonate and 10% struvite, surrounded by a shell of 85% magnesium calcium phosphate carbonate and 15% struvite. The formation of stones in the kidneys varies in size and shape. Considering the composition of the components, single formations such as xanthine and cystine are observed,

while the concentration of phosphate in beef cattle and carbonate components in pasture cattle. There are few reports in the worldwide veterinary literature on quantitative analysis of bovine uroliths(Bauza et al,2018). In the studies conduced, it is stated that concentrate feed, environmental conditions, drugs used and vitamin D contribute significantly to stone formation especially in beef cattle. There are many studies supporting that kidney stones may cause degenerative and necrotic changes and tumoral formation in the animal's developmental, circulatory and excretory systems(Maraşlı et al;1995; Sunyeoz,2008).

There are a few reports on quantitative analysis of bovine uroliths in the world's veterinary literature. Urethral obstruction has been extensively reported in ruminant species(Gasthuys et al, 1995). An overall incidence of 5.04 percent in animals has been reported in India(Smith et al., 1989).

Incidence of urolithiasis as high as 13,4%, in Anantnag, 12,6%, Budgam 11,9%, Pulwama 6,9%, and Srinagar 10,5% in male cow calves (Makhdoomi & Gazi, 2013). Outbreaks of urolithiasis in castrated range cattle have been described in Mato Grosso do Sul and Minas Gerais without a determination of causes (Mcintosh et al.,1974). Urolithiasis have also been described in range ruminants in Australia and Turkey (Yüksel and Yaman, 2008; Maraşlı et al;1995; Güven et al, 2003; Mcintosh et al.,1974). In a study conducted to reveal the incidence and pathological findings of kidney lesions of cattle slaughtered in Elazığ slaughterhouses, kidney lesions were found in 64 (4,18 %) of the 1431 cattle (Yüksel &Yaman, 2008). In the light of all these data, as a result of kidney and urinary tract stones, factors such as pain in the animal, inability to urinate or drop by drop, discharge, deterioration of the general condition swelling will adversely affect the milk yield and body mass of the animal, so food that encourages stone formation in fattening or pasture livestock and drug use should be avoided.

Availability of Data and Materials

Datasets analyzed during the current study are available in the author on reasonable request.

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Conflict o Interest

The article authors declare that there is no conflict of interest between them.

Author's Contributions

The authors state that they have contributed to the study as 50%, 35% and 15%, in order of authorship.

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