



Anatomical analysis of renal tissue histogram in honamlı goats

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ABSTRACT

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Honamlı goats are a breed that is widely bred by public in the Mediterranean region. Urinary system diseases in goats are frequently seen diseases that reduce productivity. Diseases such as renal failure, acute and chronic kidney diseases, renal steatosis, non-hypercalciuria urolithiasis are frequently seen renal diseases in goats. However, the ultrasonography method used in the early diagnosis of these diseases cannot be diagnosed by macroscopic examination. Image analysis programs are also used to diagnose kidney diseases that cannot be diagnosed in ultrasonographic images.

In this study, 24 healthy Honamlı goats (12 males, 12 females) were used. 24 of the goats (12 males, 12 females) were animals over 2 years old. In the study, ultrasound images were taken from both kidneys using a 6.5 Mhz probe. Normative data were obtained in healthy animals by performing histogram analysis on the images.

Key Words: Characterization, kidney, ultrasound.

1. INTRODUCTION

Honamlı goats are a goat breed specific to Turkey, especially the Teke region. This breed has an important place in the livestock culture of the region. However, common health problems in goats include non-hypercalciuria, urolithiasis (urinary tract stones), acute and chronic renal diseases. These diseases can negatively affect kidney function in goats and pose a significant diagnostic and treatment challenge for veterinarians (1). Research on it provides information on the diagnosis and management of these diseases, especially in different goat breeds (2). However, there

are no specific normative data in the literature regarding the diagnosis of renal diseases in Honamlı goats.

Ultrasonography is a common imaging method used by veterinarians to examine internal organs. However, in the early stages of kidney diseases, there may be pathologies that cannot be seen in ultrasonographic images. At this point, in recent years, image analysis programs have been helping in the diagnosis process with detailed color analyzes performed on ultrasonographic images. Although ultrasonographic images consist of 256 color tones, color analysis



Figure 1. Ultrasonographic imaging and histogram analysis of the kidney in a female Honamli goat.

programs have been developed to detect subtle changes in these images more precisely (3). Thanks to this technique, invisible changes in ultrasonographic examination of urinary system diseases in goats can be detected in the early stages. However, the lack of such normative data for Honamli goats indicates a significant gap in the health management of this particular breed in the region. This study aims to present normative data obtained by ultrasonographic image analysis, which may help in the early diagnosis of kidney diseases in Honamli goats. Thus, using these data in clinical practices will be an important step towards ensuring a healthier animal husbandry practice.

2. MATERIALS AND METHODS

In this study, 24 healthy Honamli goats (12 males, 12 females) were used. All 24 goats (12 males, 12 females) were animals that had reached the age of 2. The goats were first subjected to a physical examination, hemogram test, and serum biochemistry tests at the Animal Hospital of the Faculty of Veterinary Medicine, Burdur Mehmet Akif Ersoy University.

They were positioned in a standing posture to obtain images via an ultrasound device located within the animal hospital using a 6.5 MHz probe, The ultrasound settings were; Gain 86 decibel (dB), frame rate 78 frame per second (fps), dynamic range 65 decibel dB, depth 6.2 millimeter (mm). ultrasound

Table 1: Histogram analysis table of goats (Mean ± Standard Deviation)

Histogram analysis data of female Honamli goats(n:12)	Histogram analysis data of male Honamli goats(n:12)
25.952±9.306	33.317±6.696
27.548±6.848	31.541±7.294
21.649±7.489	29.315±6.927
28.672±6.374	36.975±7.198
24.772±3.968	45.325±9.252
28.258±5.679	40.752±6.263
23.378±3.849	42.564±5.848
22.897±3.149	34.618±4.156
24.549±2.165	36.489±3.894
25.116±3.149	39.948±6.848
24.341±4.481	41.812±4.489
26.498±3.169	42.489±6.487

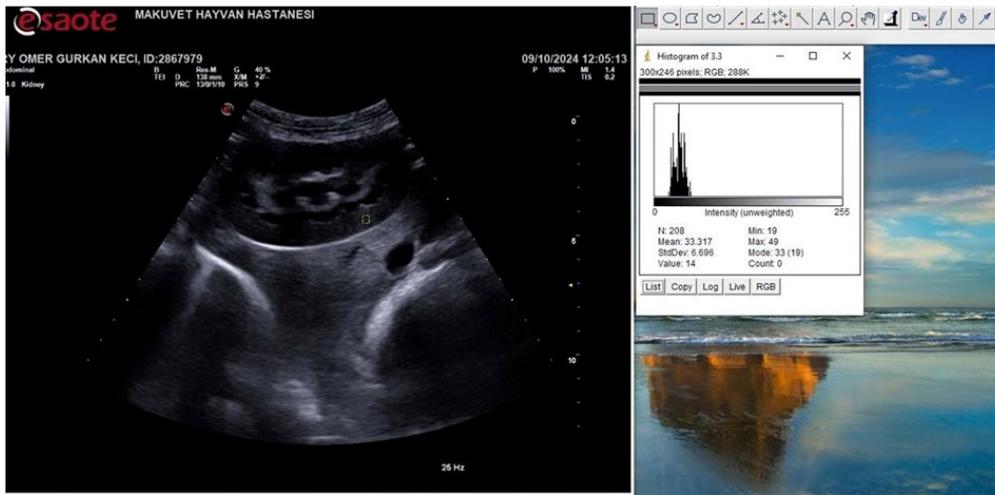


Figure 2. Ultrasonographic imaging and histogram analysis of the kidney in a male Honamlı goat.

images were obtained from both kidneys (Figure 1-2). In order to standardize the images, the Time Gain Compensation (TGC) setting of the ultrasound device was kept fixed during the examination of all goats. The ultrasound images obtained were analyzed using the Image J program, where three different regions of interest (ROIs) from the cortex area of both kidneys were defined (Figures 1, 2). Histogram analysis of the images of these ROIs was performed to obtain quantitative data. These data serve as normative values that can assist in the diagnosis of lesions that cannot be macroscopically seen in the kidneys in ultrasound images and can be used as valuable data in clinical practices. The data obtained were recorded in the SPSS program as Mean±Std. Dev.

3. RESULT AND DISCUSSION

As a result of the study, ultrasonography examinations were performed on 12 male and 12 female adult Honamlı goats. For the numerical image analysis of the images obtained from the Honamlı goats, histogram analysis of each cortex renalis region was conducted using the Image J program (Figures 1-2). The obtained data were presented as mean ± standard deviation. The results of the histogram analysis are presented in Table 1.

In this study, the aim was to establish normative data for the ultrasonographic evaluation of kidney tissue in Honamlı goats, a breed endemic to the Teke region, with particular attention to the diagnosis of kidney

diseases. By using the Image J program for image analysis, detailed quantitative data were obtained that could assist in the early detection of kidney lesions that might not be visible in standard ultrasonographic images. Urinary system diseases are commonly seen in goats (4). Kimberling and Arnold (5) found that the incidence of renal failure, acute kidney disease, and chronic kidney disease in goats was 13%. It has also been reported that the incidence of non-hypercalciuric urolithiasis is 12%. Breed-specific studies on renal diseases have been conducted, but there is no literature on renal diseases in Honamlı goats. Considering the widespread occurrence of kidney diseases, such as non-hypercalciuric urolithiasis, acute and chronic kidney disorders, in goats, it is important to develop breed-specific diagnostic tools, especially for less-studied breeds like Honamlı goats.

Biopsy is frequently used as a diagnostic method for kidney diseases. However, biopsy is an invasive method, and complications after biopsy have been reported (6). Another method used in the diagnosis of renal diseases is ultrasonography. Ultrasonography is non-invasive, allows for sequential imaging, and does not have any harmful effects on the patient (7). For this reason, it is currently used as a preferred diagnostic tool in both human and veterinary medicine. Through ultrasonography, information regarding the shape, size, and echogenicity of the kidneys can be obtained. However, it has also been

reported that in some disease conditions, diagnosis from macroscopic images obtained via ultrasonography may not be possible. Therefore, it is recommended to use image analysis methods for more accurate interpretation of ultrasonographic images for diagnostic purposes. Through various studies, histogram analysis techniques have been developed for images obtained from different tissues and organs. Image analysis programs are also used to diagnose kidney diseases that cannot be detected in ultrasonographic images.

The basic logic in these programs is based on performing detailed color analyses on ultrasonographic images that contain 256 colors, although the human eye can only perceive about 10-12 colors (6). Using this technique, normative quantitative data are presented that could help in the early diagnosis of diseases not visible in ultrasonographic examinations of the urinary system in goats. The data obtained in this study can serve as normative data for healthy Honamlı goats.

In our study, histogram analysis of the ultrasonographic images revealed significant differences between the renal cortex of male and female goats and highlighted the potential effects of sex on kidney characteristics. The average values of the histogram analysis for female goats ranged from 21.649 to 28.672, while higher values ranging from 29.315 to 45.325 were observed in male goats. This variation suggests that sex may have an effect on the ultrasonographic features of the kidneys and may likely reflect natural physiological differences in kidney size or tissue composition between males and females. Future studies exploring these differences in more detail may provide insights into sex-specific changes in kidney structure that could affect early detection of kidney diseases.

These findings are important considering the use of ultrasonography as a non-invasive diagnostic tool. The ability to assess kidney tissues using detailed color analysis of ultrasonographic images represents a promising approach to detecting pathological changes often overlooked by the human eye.

Techniques such as histogram analysis enable clinicians to obtain valuable quantitative data from these images, potentially identifying issues such as early-stage kidney lesions or irregularities in kidney structure (6). Thus, the normative data provided in this study could assist in establishing baseline values for Honamlı goats and be used for comparative purposes in clinical settings to identify abnormal kidney function or pathology at an early stage.

Furthermore, the absence of existing normative data specific to Honamlı goats highlights the importance of this study in filling a critical gap in veterinary diagnostics for this breed. Previous research on urolithiasis and kidney diseases in goats has primarily focused on other breeds without accounting for breed-specific differences in kidney morphology or function (6, 7). This study contributes valuable information by creating a reference for the Honamlı goat, which has significant economic and cultural value in the Teke region, and can help in the precise diagnosis and treatment of kidney diseases in this local breed.

The results of this study could have broader applications for diagnosing kidney diseases in other goat breeds, particularly those with similar ecological and physiological characteristics. Given the non-invasive nature of ultrasonography and the usefulness of the Image J program for quantitative analysis, this approach can be adapted for large-scale veterinary practices and help monitor the health of goat populations over time, providing a tool for early intervention in the treatment of kidney diseases.

4. CONCLUSION

In conclusion, the establishment of normative data for the ultrasonographic evaluation of kidneys in Honamlı goats provides an important foundation for the early diagnosis of kidney diseases in this breed. Future studies should aim to investigate the relationship between these ultrasonographic measurements and clinical outcomes, as well as explore the long-term effects of kidney diseases in Honamlı goats.

Moreover, further research could examine potential environmental, dietary, and genetic factors contributing to kidney health in this breed, potentially improving the overall health and productivity of Honamlı goats in the region.

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Conflicts of Interest: The authors declared that there is no conflict of interest.

Ethical Statement: The study was conducted with the permission number 14.04.2021-760 from the Local Ethics Committee on Animal Experiments of Burdur Mehmet Akif Ersoy University.

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