

## Ultrasonographic anatomy of the goat eye

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### Abstract

Domestic goats (*Capra hircus*) are a ruminant species important in the economy of several countries. Considering the health implications and the economic potential of goats, the issue of investigating the clinical characteristics of goat's eye is of considerable relevance. In goats, Pinkeye (keratoconjunctivitis) is the inflammation of the inside of the eyelid and considers as a highly contagious infection that spreads through contact, outbreaks frequently occur when new goats are introduced to the herd. So this study aimed to report the normal echobiometric anatomy of Iraqi goats' eye in order to know the clinical aspect of the ocular structures and the normal range of ocular parameters by using the sonographic machine. Ocular echobiometric inspections were achieved on 20 goats (10-14 months old) from local breed. Ultrasonographic images were obtained with a 7.5 MHz linear probe in the sagittal plane. Results showed; that the axial globe length (AGL) was (20.4±0.2mm), anterior chamber depth (ACD) (1.98±0.14mm), vitreous chamber depth (VCD) (9.85±0.12mm), sclera-retinal rim thickness (SRT) (1.6±0.08mm), lens thickness (LT) (7.77±0.22mm) and corneal thickness (CT) (0.59±0.01mm) respectively. The estimated dimensions of the normal ocular components which gained from this study by using sonographic machine give eminent schedule to veterinarians in the appraisal of ocular diseases in goats.

**Key words:** Ultrasonographic anatomy, goat eye, eye anatomy, eye ultrasonography.

### التشريح الفوق الصوتي لعين الماعز

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### الخلاصة

يعتبر الماعز احد الحيوانات المجترة المهمة اقتصاديا في العديد من البلدان و لذلك فإن المحافظة على هذه الثروة يعلب دورا بارزا في حفظ إنتاجية هذا الحيوان ، إن التهاب الرمد الساري لقرنية العين في الماعز يعتبر احد الأمراض السريعة الانتشار في قطعان تربية الماعز مسببة خسائر اقتصادية كبيرة لذلك فإن الهدف من هذه الدراسة هو بيان المكونات التشريحية الطبيعية لأجزاء العين في المعز و من النوع المحلي ، و لمعرفة هذه المكونات تم استخدام جهاز السونار (جهاز الموجات فوق الصوتية) ، أجريت الدراسة للعين على (20) عينة لماعز تراوحت أعمارها (10 – 14 شهراً) و تم الحصول على صور جهاز الموجات فوق الصوتية باستعمال مسبار مستقيمي (Linear Probe) و بقوة هرتزيه وصلت إلى (7.5) ميغا هرتز و بالوضع السهمي (Sagittal Plane). أظهرت نتائج الدراسة أن المحور الطولي لكرة العين بلغ (20.4±0.2) ملم و عمق الحجرة الأمامية للعين بلغ (1.98±0.14) ملم و عمق الجسم الزجاجي (9.85±0.12) ملم و عمق الحيد الشبكي الصليبي بلغ (1.6±0.08) ملم و سمك العدسة بلغ (7.77±0.22) ملم و سمك قرنية العين بلغ (0.59±0.01) ملم على التوالي. أن قيم و أبعاد المكونات التشريحية للعين الطبيعية في الماعز و التي تم الحصول عليها من هذه الدراسة باستخدام جهاز السونار تعطي دليلا ممتازا للممارسين السريريين في تقييم و تشخيص أمراض العيون. الكلمات المفتاحية: التشريح فوق الصوتي ، عين الماعز ، تشريح العين ، التصوير فوق الصوتي للعين.

### Introduction

The domestic goat is a sociable, obtrusive, and astute species, which has been used for its meat, milk, skin, and fur since its first domesticated ca. 10,000 years ago (1). The

goat (*Capra hircus*) represents one of the most important farm animal species, In recent years, demand for goat products has increased in both developing and developed

countries (2, 3, 4). It is renowned that ocular lesions in food-producing animals play a worthy role in economic losses. In goats, outbreaks of infectious keratoconjunctivitis and cases of phenothiazine toxicosis may cause corneal opacity. Corneal edema is a general clinical sign of corneal ulceration, keratitis, anterior uveitis, and many systemic diseases, and prevents the direct visualization of intraocular structures by ophthalmoscopy. Therefore, alternative diagnostic methods for intraocular diseases must be explored (5, 6). Knowledge of the dimensions of ocular components is required for better understanding of many research and clinical disorders in vision (7). Echobiometric evaluation of the eye was one of the early uses of ultrasound of human ophthalmology (8). Trans-corneal sonographies qualify the clinician to estimate the intraocular components in opaque eyes. Ocular echobiometry is a useful tool for the assessment of anomalies and diseases such as phthisis bulbi, microphthalmia, pseudo exophthalmia, scleral ectasia, and congenital glaucoma. Additionally, biometry values are frequently used for the construction of schematic eyes in optics (9, 10). The knowledge of the echobiometric appearance and normal dimensions of the eye would serve as a basis for sonographic examinations when eye disease may have caused alterations in the dimensions and appearance (11). For this reason, the study aimed to describe the normal ultrasonographic appearance and measurement of the ocular component in Iraqi goats' eye.

### Materials and methods

Twenty trans palpebral ocular echo biometric examinations were performed on 20 young healthy Iraqi (local breed) goat eye (10-14 months old). The estimations were achieved with the animals restrained, without the use of sedation or topical analgesia. Sonographic examinations were accomplished with an ultrasound machine (Edan D6, Edan Instrument, Inc, China) using a 7.5 MHz linear transducer. The probe was placed in a sagittal plane and the ocular

dimensions were recorded by which cadastre is performed through the upper eyelid by using a lot of coupling gel being applied directly to the eyelid and the images were saved. Ocular distances were measured from the standard views using caliber of the ultrasound machine. Optimal B-scan images along the central optic axis enabled to record six intraocular dimensions: Axial globe length (AGL, was measured from the anterior corneal surface to the retina), anterior chamber depth (ACD, was measured as the distance between echoes from the posterior corneal surface and the anterior lens surface), vitreous chamber depth (VCD, was the distance between echoes from the posterior lens surface and the retina), sclera-retinal rim thickness (SRT), lens thickness (LT, was the distance between echoes from the anterior and posterior lens surfaces) and corneal thickness (CT, was measured between the echoes from the anterior and posterior corneal surfaces). The mean and standard deviation for each set of measurements were calculated and ocular dimensions and data are presented as mean  $\pm$  standard deviation.

### Results

The sonographic images of goat eyes in the present study revealed that the aqueous humor which the fluid filled the vitreous body represented as anechoic region, as well as the internal appearance of the lens (which trapped between anterior and posterior lens capsule) appeared anechoic. The anterior chamber (the area restricted between the hind part of cornea and anterior lens capsule) appeared as a single, anechoic area (Fig. 1). The cornea represented as a dual-tip echo (two convex lines), the first one corresponding to its epithelium and the second to its descemet membrane (Fig. 2). As general the study revealed that the cornea, anterior and posterior lens capsule, sclera considered the hyper echoic parts in the goat eye. The scleroretinal rim appeared as a concave echogenic line at the posterior margin of the eye ball. The anterior lens capsule appeared as a convex echogenic line, while the posterior lens capsule appeared as a concave



**Fig. (1):** Sagittal B-mode ultra-sonogram of goat eye showed; Axial globe length (AGL), Anterior chamber depth (ACD), Vitreous chamber depth (VCD), Optic nerve region (ON).



**Fig. (2):** Sagittal B-mode ultra-sonogram of goat eye, showed, 1-Cornea, 1'-Anterior surface of cornea, 1''-Posterior surface of cornea 2-Anterior lens capsule (ALC), 3-Posterior lens capsule (PLC), 4- Scleroretinal rim.

echogenic line, and the lens which restricted between it appeared as an anechoic area (Fig. 2). The echo biometric measurements of ocular components were recorded as follows; The axial globe length (AGL) was (20.4±0.2mm), anterior chamber depth (ACD) (1.98±0.14mm), vitreous chamber depth (VCD) (9.85±0.12mm), scleroretinal rim thickness (SRT) (1.6±0.08mm), lens thickness (LT) (7.77±0.22mm), and corneal thickness (CT) (0.59±0.01mm) respectively (Table 1).

## Discussion

As it is well known to us this is the first study of ultrasonographic anatomy and echobiometry of the ocular components have been detected in goat in Iraq. The sonographic images give an exquisite index to evaluate the ocular and orbit (12, 13). The ultrasonographic scanning of the present study revealed that the anechoic nature of some parts of the globe of the caprine eye are similar in that in bovine and ovine (9, 14), this came in agreement with the fact that say, whereas areas with no echoes are said to be anechoic or (echo free). The study showed that the echo texture nature of the aqueous humor goat eyes are found as a fine regular and homogeneous, this ultrasonographic result came similar to those described in horse, dogs, bovine and ovine, also the anterior chamber appeared as homogenous, anechoic regions due to it filled with aqueous fluids which the velocities that across the aqueous fluids are similar to that in water, therefore appeared as anechoic region, this result came in agreement with (9,14,15, and 16). The hyper echoic parts in this study represented by the cornea, scleroretinal rim and lens capsule (anterior and posterior capsule) came similar to that which viewed in ovine, buffalo and bovine, but in different

**Table (1):Ultrasonographic measurements of eye goat components (Mean ± SD) per mm.**

Parameter	Mean ± SD (mm)
Axial globe length	20.4±0.2
Anterior chamber depth	1.98±0.14
Vitreous chamber depth	9.85±0.12
Sclero-retinal rim thickness	1.6±0.08
Lens thickness	7.77±0.22
Cornel thickness	0.59±0.01

measurements due to the size of animals, this hyper echogenicity resulted from that the hyper echoic organs reflected more echo to transducer and appeared as white dots aggregated in small lines in shape depending on the molecular nature of the tissue. (9,14, and17). Ultrasonographic evaluation of the penetration of echo to eye components which obtained from this study came compatible in other ruminant (9, 13, 14, and 18), our study used liner probe (7.5 MHz) provides better depth of penetration approximately 2–5 cm, and it can be used in ocular ultrasonography. The ultrasonographic examination of the axial globe length, vitreous body depth, corneal thickness, scleroretinal rim thickness and lens thickness reported by this study revealed many similarities to those described in cattle, dogs, Buffalo and horses, with some variations in the shape and dimensions (9, 11, 12, 14, 17, and18). The goal of this study steered to provide the normal ultrasonographic guide (echobiometry measurements) of the goat eye by using a widely available and valuable diagnostic tool (ultrasonographic machine), which provided well standard line acquaintance for the study of pathologic conditions affecting the ocular components of goat.

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