ANATOMICAL, HISTOLOGICAL AND RADIOLOGICAL STUDY OF THE MAMMARY GLAND OF SMALL RUMINANTS

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ABSTRACT

Anatomical with Histological structures of the mammary gland in small ruminants [Ewe and She goat] as well as the pattern of intra mammary duct system using mammography were studies to obtain more details information about the mammary glands of small ruminants for its value in production of milk.

INTRODUCTION

Investigation of mammary gland in different animals have been carried by several authors (1, 2) study the biometry of udder and teat in goat and (3) reported the histological changes in the mammary gland of Ewe in relation of estrogen, mammary gland of she camel was studied by (4, 5-6). In buffalo the mammary gland development of the udder and teat were reported by (8, 9) in cattle. The aim of present work is to report more detailed studies in the mammary glands in small ruminants {Ewe and she goat} which they have great value for the people for meat, wool and milk production.

MATERIAL AN METHODS

The present work was designed to study the Anatomical Features, Histological structure and Radiographic appearance of the intra mammary pattern of the duct system in small ruminants. All specimens were collected from Al_Fudailia slaughter house.

Anatomical study:

Entire udder was immediately removed after slaughtering animal. Care was taken to avoid injure the udder tissue. Only apparently healthy and normal appearance udders were

taken after examination. Five udders from each Ewe and she goat of 2-4 years were taken to study the shape of udder, external features and teat. For biometric study which include length, width and depth of udder as well as the length and diameter of teat were down on the previous ten udders as well as ten udders from each Ewe and she goat were measured in the slaughter house.

The measurements of udder and teat were down as following

1. Length of udder: is distance between the cranial and caudal attachment of udder with the body.
2. Width of udder: is distance between the two lateral line of attachment with the abdominal wall
3. Depth of udder: is distance between the base of udder and lowest point of udder((inter mammary groove))
4. Length of teat: from the base of teat to the Apex.
5. Diameter of teat: is down at the mid point it's length (2).

All the measurements down by using venier Callipers and measurement tap.

Histological study:

Five udders from each Ewe and she goat of 2-4 years immediately taken from carcasses . Tissue sample from different parts of gland (upper, middle and lower parts) and from the base, middle and Apex of teat were taken. All specimens were fixed in 10% formalin then routine histological technique was made [dehydration, clearing, embedding in paraffin then sectioning in 5-7 µm. The sections were stained with [Hemoxylin and eosin, Van-Giesson, and Verhoffes stain (10, 11)]

Radiological study:

The Radiological study was down by making contrast Radiographs from fresh isolated mammary gland. Five udder from each Ewe and she goat 2-4 years normally appearance and have no any pathological lesions. They were taken immediately after slaughtering by cutting at the base of udder with a part of abdominal muscles. Care where taken to avoid injury or damage of udder tissue; the udders were kept in cool box with ice for Further study:

For X ray study certain parameters were used [50 kvp , 3 mAs an 30 cm as focus film distance]two type of contrast medium were used.

a. Conray 480 [sodium lothalamate 80% wlv]
b. Urovido 75%

They used to visualize and define the shape of teat canal, lactiferous sinus and intra mammary pattern of duct system.

The contrast medium was injected by hand using 50 ml syringe with polyethylene catheter of 20 cm length and 1.5 mm outside diameter through the teat orifice. The contrast medium was injected in dosage of 10 ml. Four dosages were use respectively and a single Radiograph after each injection was taken.

RESULTS

If there is no any difference in the result between Ewe and she goat the results will be illustrated under the name of small ruminants and if there is difference between them will be define in sheep or goat.

Anatomical study:

The udder in Ewe and she goat composed of two glands (two halves) each drained with its own teat, of single teat canal possess single teat orifice.

In small ruminant the udder is located in the inguinal region and the two gland (left and right gland) are located on each side of ventral mid line, externally both halves are indicated by median inter mammary groove Fig (1). The gland covered by pigmented skin with fine hairs until the base of teat. Generally the udder and teat in she goat are larger than in Ewe Table (1). The teat in she goat is conical in shape wide at the base and protrudes like a funnel from the udder. It is directed Latero-ventrally and no specific point of connection with the udder were seen Fig (1). While in the Ewe the teat is short cylindrical directed carnio-ventrally Fig (1).The average length and diameter of the teat in Ewe and she goats are seen in Table (2). Supernumerary teat are commonly seen in both Ewe and she goat Fig (1). Some of these teat open in to normal gland so it called true teat others do not opened in to gland so it called pseudo teat .The gross examination of the mucous membrane of the teat canal showing numerous longitudinal folds in the mucous membrane lining the teat canal in she goat Fig (2). While they are absent in mucous membrane of the teat canal in Ewe which appear smooth Fig (3).

Histological study:

- **Lactating mammary glands**

The Lactating mammary glands in small ruminants are composed of tubulo-alveolar glands. The gland is composed of many histological lobes which are separated from each other by interlobular connective tissue. The lobes are subdivided in to many lobules by strand of connective tissue [intralobular connective tissue] originated from interlobular connective tissue ,alveolus also surrounding by fine strand of fibrous connective tissue Fig (4,5).

The parenchyma of mammary gland consists of alveoli, network of ducts and bundles of connective tissue. The alveolus is the basic secretary unit it is sac like or vesicle of unequal size. They are made of flattened or cuboidal epithelial cells with round nucleus Fig (5). Myoepithelial cell present in between the basement membrane and epithelium lining the alveolus Fig (4).

- **Duct system of lactating gland**

In small ruminants the duct system begins at the alveoli by small intralobular duct which lined by simple cuboidal cells, myoepithelial cells are seen between the basment membrane and epithelium lining of the duct Fig (4). The intralobular duct drained by interlobular duct, which is surrounding by connective tissue and lined by two layers of cuboidal cells. Fig (5), several interlobular ducts empty in large ducts that are lactiferous duct (collecting duct). It is the excretory duct of the lobe and opens in to lactiferous sinus. The collecting duct line by two layers of cuboidal cells Fig (6).

The lactiferous sinus is wide pouch with irregular out line received milk from the lactiferous ducts. It lined by two layers of cuboidal cells and the lamina properia rich with elastic fibers and surrounded by circular smooth muscle fibers Fig (7).

- **Structure of teat**

In both lactating and non lactating mammary gland of small ruminants the teat has similar structure. The wall of the teat consists of three layers.

The first layer which is the most outer layer is the normal skin formed from epidermis and dermis has few number of fine hairs usually associated with clusters of sebaceous glands surrounding the hair follicles. Fig (8) the hair is completely absent at the middle and tip of teat.

The second layer is the fibro - musculo-vascular layer which is the thick layer and formed most thickness of the teat wall, it is composed mainly of dens connective tissue made of bundles of collagen fibers , fibroblast and elastic fibers , blood vessels and there is numerous of small clusters of accessory glands specially at the base of teat . Fig (9) smooth muscles fibers arranged in circular manner at the base of teat Fig (9).

The third layer (most inner layer) is the epithelial lining of the teat sinus and teat orifice. The teat sinus is lined by two layer of cuboidal cell these will converted in to stratified sequamous keratinize at the teat orifice Fig(10)

- **Non lactating mammary glands**

In small ruminantss the non lactating glands are composed mainly of interstitial tissue composed of bundles of collagen fibers, elastic fibers and abundant amount of fatty tissue. The glandular tissue elements appeared as small isolated lobules formed mainly from intralobular ducts and few small round alveoli which lined by simple cuboidal cells with small nuclei, myeoepithelial cells are present in between the epithelium of ducts or alveoli and their basement membrane. Fig (11).

Radiological study:

Mammography is special term used in radiology means examination to investigate the internal structure of mammary gland [pattern of intra mammary duct system]. The radiographic finding of present work showed that at starting of injection contrast medium 10 ml in both udder of Ewe and she goat through the teat orifice. The contrast medium pass dorsally through the teat canal. In Ewe the teat canal appears smooth, has no pockets and has clear constriction at its base where it connected with lactiferous sinus. The lactiferous sinus appear irregular is shape. Small amount if contrast medium pass in few number of collecting ducts (lactiferous duct) Fig (12). In she goat the teat canal appear conical in shape with smooth surface, no pockets are present. The teat canal attached by its basal wide lumen with lactiferous sinus, the lactiferous sinus clearly divided in to two parts. Fig (12).At second injection (20 ml) in Ewe the lactiferous sinus filled with contrast medium and complete irregular out line appear. Amount of contrast medium enter to the collecting ducts and their tributaries which appear as the branches of tree Fig (13). As injection was progressive (30 ml) in Ewe more contrast medium enter to lactiferous ducts and their branches. In she goat The contrast medium start to enter the lactiferous ducts Fig (14).

When the contrast medium was increased due to more injection (40 ml) in both small ruminantss the pattern of duct system disappeared.

Table (1)Average values of udder measurements in Ewe and she goat in (centimeter)

Parameter	Ewe	She goat
Length of udder	15.31±0.66	16.22±0.14
Width of udder	12.73±0.21	14.92±0.16
Depth of udder	8.74±0.55	9.1±0.31

Table (2)Average values of teat measurements in Ewe and she goat (centimeter).

Parameter	Ewe	She goat
Length of teat	2.91±0.30	3.71±0.21
Width of teat	1.12±0.25	1.34±1.10
Depth of teat	4.42±0.123	5.41±0.22

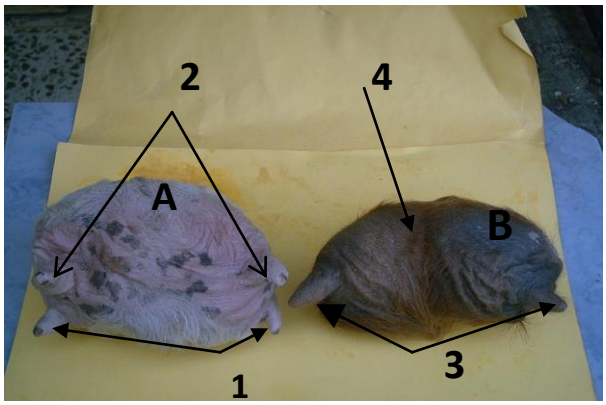

Fig (1) Showing: A- mammary gland of sheep /1-normal teats / 2- supernumerary teats /B- mammary gland of goat / 3- normal teats /4- inter mammary groove

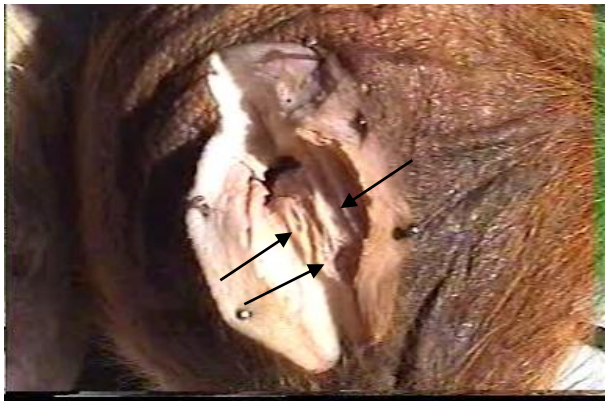

Fig (2) opened teat of mammary gland of goat showing longitudinal folds ((arrows)) in the mucous membrane lining

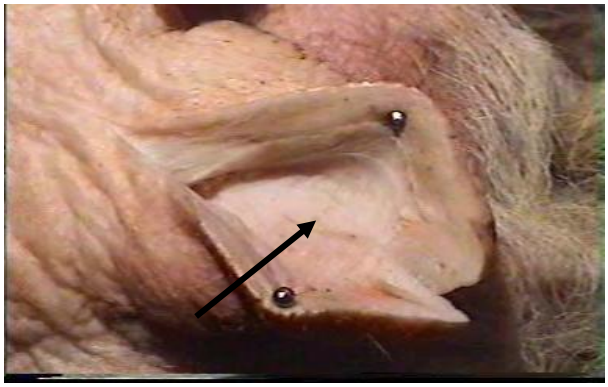

Fig (3) opened teat of mammary gland of sheep showing no longitudinal folds (smooth mucous membrane lining) ((arrow))

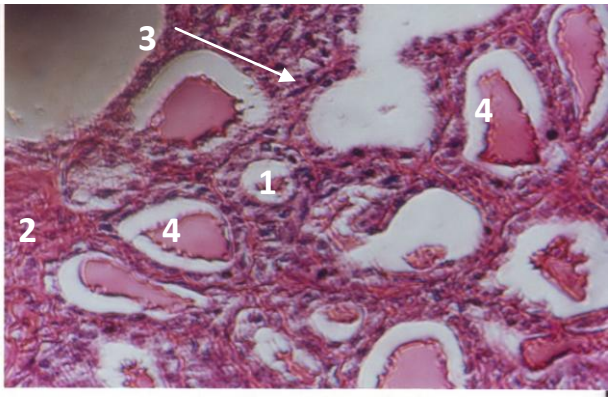

Fig (4) lactating gland of small ruminants showing: 1- intra lobular duct / 2- interlobular connective tissue / 3- myoepithelial cell /

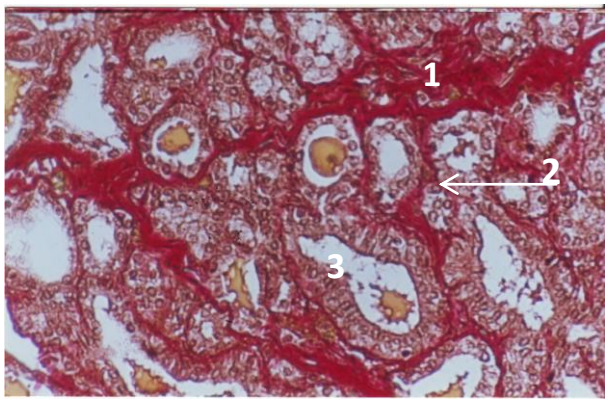

Fig (5) lactating gland of small ruminants showing :1- ntralobular connective tissue / 2-connective tissue surrounding alveolus

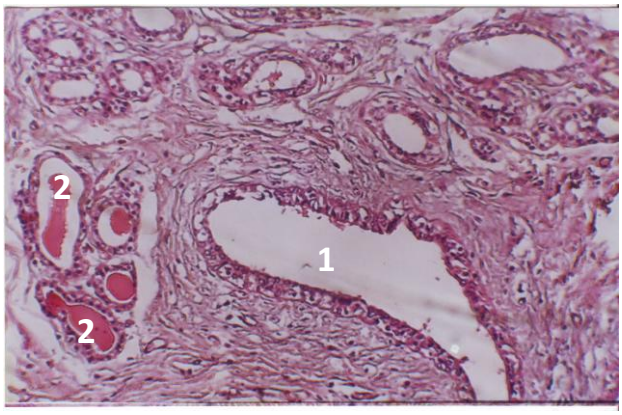

Fig (6) lactating gland of small ruminants showing: 1-lactiferous duct ((collecting duct)) / 2- alveoli

H&E X 300

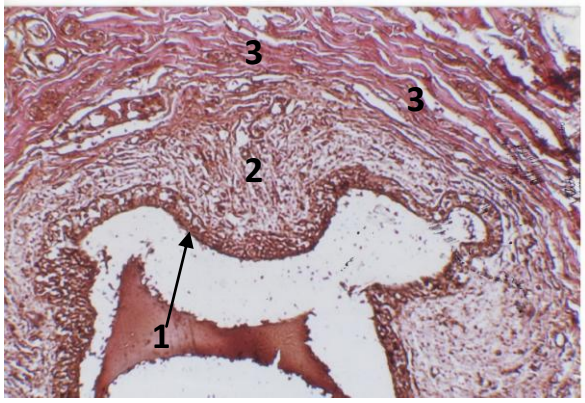

Fig (7) lactating gland of small ruminants showing: 1- lactiferous sinus epithelium lining

2- Lamina properia rich with elastic fibers

Fig (8) Skin of mammary gland of small ruminants showing/1- epiderm/2- derm/3-hair follicle /4 cluster of sebaceous gland H & E X80

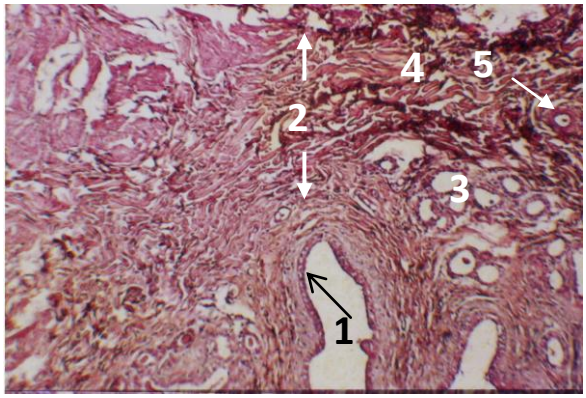

Fig (9) base of teat showing:1- epithelium lining of teat sinus /2- fibro-musculo –vascular layer/ 3- cluster of accessory gland 4- circular smooth muscle / 5-artey

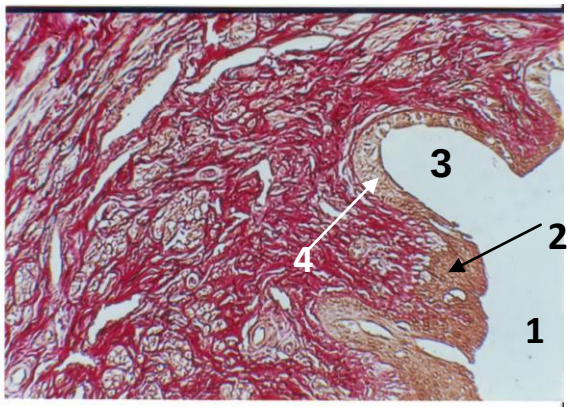

Fig (10) Teat sinus and teat canal showing:

1- Lumen of teat / 2- stratified sequomous keratinized epithelium of teat canal /3- teat sinus /4-two layer of cuboidal cell lining teat

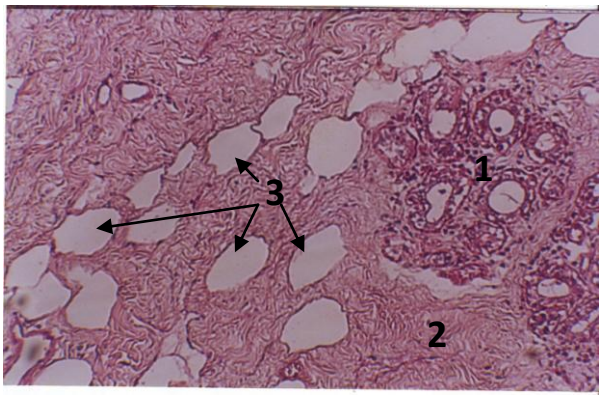

Fig (11) Non lactating mammary gland of small ruminants showing: 1-small glandular lobules / 2- abundant of connective tissue 3-aboundant of adipose tissue H&E X200

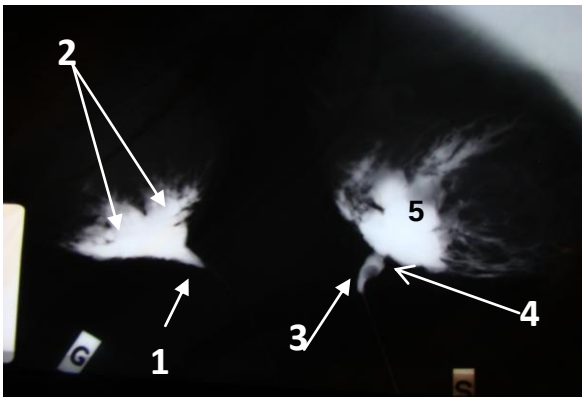

Fig (12) radiographic picture.G=Goat/1-teat canal /2- two parts of lactiferous sinus S= sheep/ 3- teat canal / 4- constriction of teat canal / 5- irregular lactiferous sinus

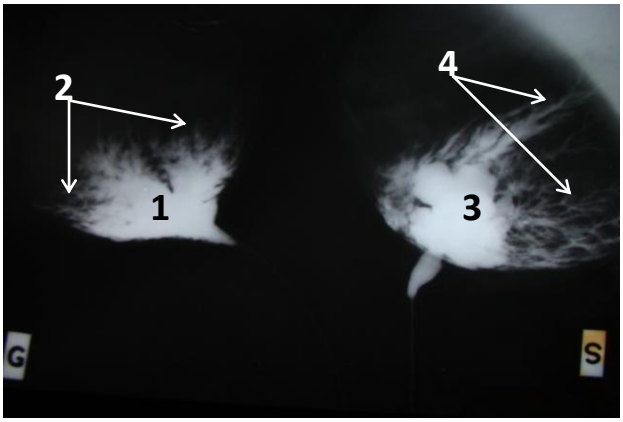

Fig (13) radiographic picture.G=Goat/1- two parts of lactiferous sinus/2- small lactiferous ducts/S= sheep/ 3- lactiferous sinus / 4- large lactiferous ducts

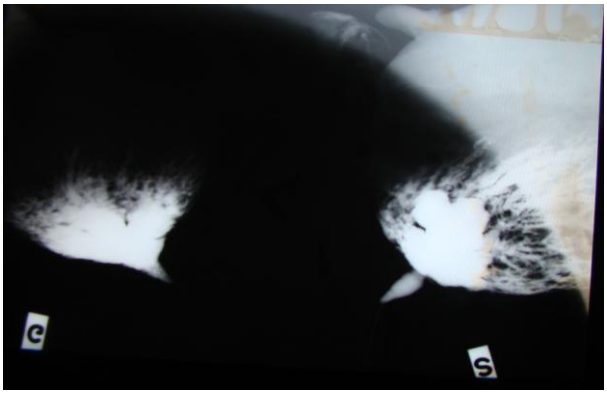

Fig (14) radiographic picture.G=Goat

S= sheep more lactiferous ducts and their tributaries are appear.

DISUSSION

- **Anatomical study**

The udder of small ruminants composed of two halves and located in the inguinal region each halve has one teat similar observation were early found by (12, 13, 14) in Ewe and she goat. The differences in the measuring of udder and teat between Ewe and she goat in normally due to different species and age as well as the stage of lactation . The supernumeraries that are common is small ruminants our suggestion is agreement with (15) who say the supernumerary teat is one of the conformation problems of udder which making nursing difficult. The present of the longitudinal fold in the teat canal lining examined grossly could be to narrow the lumen when there is no sucking or milking also to allowed the lumen distend during milking.

- **Histological study**

The mammary glands of small ruminants were made of several individual lobes surrounded by connective tissue the lobes of lactating gland are larger then the lobes of the non lactating gland. Our suggestion was agreed with suggestion of (16) in cow who said that the increasing in the size of lobules and lobes in lactating gland due to rapid growth of glandular tissue as a result of hormonal effects. The variations of alveolar lining within same lobule indicate that the alveoli in the lobule are not in same secretory phase at the same time (17)

- **Duct system**

The duct system begins at the alveolus as small intra lobular duct lined by simple cuboidal and become columnar in large duct. The interlobular duct is formed from the union of several intralobular ducts. It is large and lined by two layer of cuboidal cells, myoepithial cell present around both type of ducts .This finding is similar to that of (18, 19) in goat.

- **Structure of teat**

in both lactating and non lactating glands the teat wall formed from three layer this is similar to result of (20).

The present of large luminal arteries and veins in the fiber musco vascular layer of the teat is in agreement with the suggestion of (12) in she goat who said that more blood vessels in the teat might be responsible for erection of teat. The epithelium lining the teat canal and teat orifice is keratinized stratified sequamous epithelium seem to be of value in resistance against infection (21).There is small clusters of accessory compound glands in the lamina properia of the teat sinus is siminllar to the finding of (19) in goat.

- **Non lactating gland**

The non lactating mammary gland in small ruminants consist mainly from interstitial connective tissue of collagen bundle and abundant of elastic fibers and adipose tissue more than glandular tissue ,our findings were agreement with (5) in camel, (22) in buffalo and (23) in bovine .

- **Radiological study**

Each halve in the udder of Ewe and she goat has single gland with its own teat this finding not in agreement with result of (6) in camel which remembers that each quarter has two separated gland.

The smooth surface of the mucous membrane and the absent of pockets in the teat canal of small ruminants of clinical interests in lowing incidence of mastitis, this suggestion seem to be in agree with that reported by (24) in cow who discus the present of pockets in mucous membrane of teat canal in cow act as reservoirs of bacteria in agree with the finding of (25) in camel who said there is no pocket in mucous membrane of the teat in she camel.

دراســة تشريحيـــة ،نسيجيـــة وشعاعيـــة للغدة اللبنيـــة في المختبرات الصغيــرة

مهـدي عبـــد الكريـــم عطيـــة

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الخلاصـــة

تم دراسة الغدة اللبنية في المجترات الصغيرة ((النعاج والماعز)) تشريحيا حيث شملت الوصف العام لشكل الغدة موقعها وقياس ابعادها ودراسة التركيب النسيجي بالاضافة الى دراسة طراز توزيع الجهاز القنوي داخل الغدة بواسطة التصوير الشعاعي من اجل الحصول على وفرة من المعلومات عن الغدة اللبنية وذلك لاهميتها الكبيرة في انتاج الحليب

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