

## Morphometric and characteristics of dromedary's lymph nodes in Algeria

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### Abstract

The study was conducted to elucidate the characteristics of the topography and the macrostructure of some somatic and visceral lymph nodes of the dromedary (*Camelus dromedarius*) in

Algeria. The comparative between three breeds of camels: the Chambi belongs to region of the El Oued, Ouled Sidi Cheikh, breed in the region of Ghardaia and Tuareg breed in the region of Tamanrasset study showed that there is not much difference on the structural and morphometric plan. At the organ, the camel's lymph nodes gathered, and they are partially fused. The spatial orientation of these nodes is not established. The topography and linear characteristics of the lymph nodes of the dromedary (*Camelus dromedarius*) correspond to similar nodes of cattle, this may help us to know the immunity mechanism and above all the lymph circulation.

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## 1. Introduction

### 1.1 History of camels

The dromedary (*Camelus dromedarius*), domestic animal called: ship of the deserts. It is the major of the camelid family. It was appeared since 50 million years ago, and domesticated as an animal of pack and saddle, but it is also raised to its milk, also for its fleece and meat. Its presence has an interest as a productive mammal in the countries of North Africa and the Middle East (Yagil et al., 1994).

### 1.2 Specificity of the lymph nodes of camels

The adaptation of this species of animals living environment of the vast desert contributed to the emergence of a variety of structural and functional features in the life support systems of the body (Zine Filali and Shaw, 2004; Kamoun et al., 1989). In many works, they are rated higher adapt of the properties of the organs of the immune system, manifested

mainly by a strong resistance to a many of infections and infestations (Kayouli et al., 1995). In the literature, at present, they are faced contradictions, which concerned the specifics of the structural organization – functional blood and immune protection of camel. In this case, one of the fundamental contradictions is the affirmation of the uniqueness of the structure of the lymph nodes in the parenchyma that lacks a clear zoning typical of all other species mammals, which have shown by (Abdel-Magied et al., 2001). There is not a single point of view on the main features of the site intra special in the lymph nodes of the camel (Soliman et al., 1963; Taher et al., 1979).

In the literature, we didn't found a much studies on the camel lymph nodes. Therefore, the aim of the present study was to investigate

the macrostructure and the topography of the lymph nodes in local breeds of camels in Algeria.

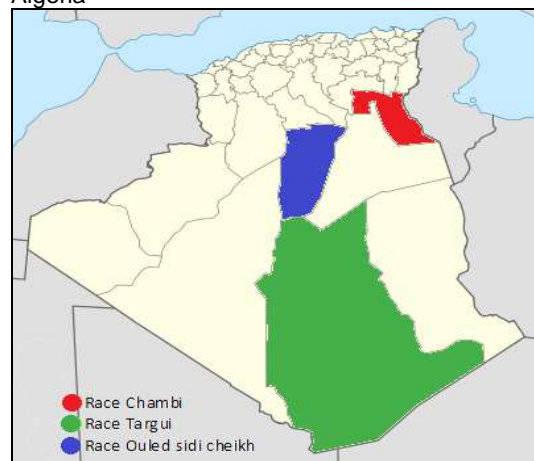
### 1.3 Characteristics and geographical distribution of camels in Algeria

There are several race camels in among the other we chose the following breeds: The Chambi breed of the region of El Oued: This breed is characterized by different variations of size and color. This is a hybrid with the blood of Arab camel. It is used for two purposes: Pack and saddle. This localized in the Western Erg and Great Oriental Erg.

Ouled Sidi Cheikh breed in region of Ghardaia, solid - set a long dark color also heavily crossed with the blood of Arab camel, it is well adapted well to walk on any kind of soil, and it is found in the highlands north of the Great Western erg.

The Tuareg breed in region of Tamanrasset: this breed is accustomed both to aid the escarpments and central Tassili Hoggar Mountains. It is a thin animal with these muscular members; his bump is small and pushed back. This is the great dromedary for border patrols which has a short-haired light color and very thin skin. It is an animal saddle of the southern sahara, found mostly in the Hoggar, the periphery and the central Sahara. fig1.

**Figure 1:** Location of dromedary breeds in southern Algeria



## 2. Materials and Methods

### 2.1 General

Camels are found in southern Algeria, since several breeds are available depending on the morphological characters. The major problem which we'll study in our work, allows us to put in evidence the general morphology of lymph nodes in the different breeds in Algeria:

Chambi, Ouled Sidi Cheikh and Tuareg represent two major Algerian breeds of the camel raised in El Oued, Ghardaia and Tamanrasset successively.

### 2.2 Animals and location

Three groups of camels, aged from 6 to 9 months, were used for this study, the animals belong to in 3 different localization zones: (Tamanrasset, El Oued and Ghardaia) 10. Fig1. Camels were slaughtered and dissected completely and consistently. Depending on the regulations of slaughterhouses animals are at rest, weighed and inspected by a veterinary, in order to identify and eliminate the sick animals.

### 2.3 lymph nodes collection and morph metric measurements

The following lymph nodes: (Parotid, sub-mandibular, The superficial cervical, Axillary, Popliteal, The medial retropharyngeal, mediastinal Caudal, Portal, Jejunal, and The medial iliac), were the subject of our study. The collected lymph nodes was performed immediately after slaughter dissection of animal, and then placed in 100 ml sterile container labeled.

The measurement of lymph nodes was carried in the laboratory of histology, immunology, chemistry and cytology pathology morphology of the scientific research center of bio-safety and environmental control of resources, the Department of General Anatomy and pathological farm animals Dnepropetrovsk DNAY. It was determined the topography, the macroscopic characteristics and morphometric parameters indices of lymph nodes. The length and width of the organs were measured using the straight edge of 0.01 cm. The absolute mass of bodies was determined using the analytical balance KERN-440-35A.

### 2.4 Data analyses

All digital data were analyzed using a "statist SF" standard program package.

## 3. Results and Discussion

The results of our studies demonstrate the lymph nodes congregate, formed as a result of the partial union of smaller units, which gives to units characteristic lobulation. In our studies we did not reveal any specific regularity in the arrangement of the separate nodes (small units) within the limits of the congregate. The forming congregate units grow together predominantly by their sides. In this case in each lymph node unit, we can see thickenings of capsule, oriented in different directions, and

clearly are distinguished. Outside the units of congregates, covered with capsule consist of dense fibrous connective tissue, and the space between their separate units (lobules) filled with friable cellulose tissue (friable unformulated connective tissue), that gives to the lymph nodes of camel the similarity to the

grooved multipapillary kidney of the mammals or the salivary gland. In general, the lymph nodes of camel have sufficiently dense consistency (dense texture), and their lobulation is perceived even through the skin during the palpation.

**Figure 2:** Superficial cervical and Parotid lymph nodes camel



according to the results obtained (Table N°1), it was found that, the larger somatic lymph node observed is the superficial cervical lymph node, it is unique constant and large lying oval node, measuring  $7.57 \pm 0.243$  cm to  $7.94 \pm 0.485$  cm length, and  $2.04 \pm 0.372$  cm to  $3.64 \pm 0.0257$  cm width. It weighs between  $7.13 \pm 0.359$  –  $7.89 \pm 0.359$  g. Mass ratio  $0.037 \pm 0.002$  % and  $0.053 \pm 0.003$  %. It is located on along the cranial edge of the biceps muscle and the serratus muscle shot. Covered by muscles brachial cephalic. It drains the surface region of the neck of the withers, the pectoral region and forelimb to flows into the thoracic canal on the left and the lymphatic vein at right sides.

The smallest somatic node, is the parotid lymph node (Fig 2) it's large, lying and flat, measuring  $2.88 \pm 0.240$  cm to  $3.12 \pm 0.156$  cm long and  $1.33 \pm 0.296$  cm to  $1.75 \pm 0.174$  cm width, the weigh varied between  $3.26 \pm 0.406$  g to  $4.13 \pm 0.298$  g, and mass ration from  $0.022 \pm 0.001\%$  and  $0.031 \pm 0.001\%$ , beneath the temporo-mandibular joint in front of the parotid gland and below the additive canal. It drains the upper part of the head. Whereas, the Sub-mandibular (Fig3) lymph node are large, elongated, more or less flattened, measuring  $6,07 \pm 0,273$  cm to  $7,39 \pm 0,404$  cm in length and  $3.47 \pm 0.367$  cm to  $4.17 \pm 0.470$  cm

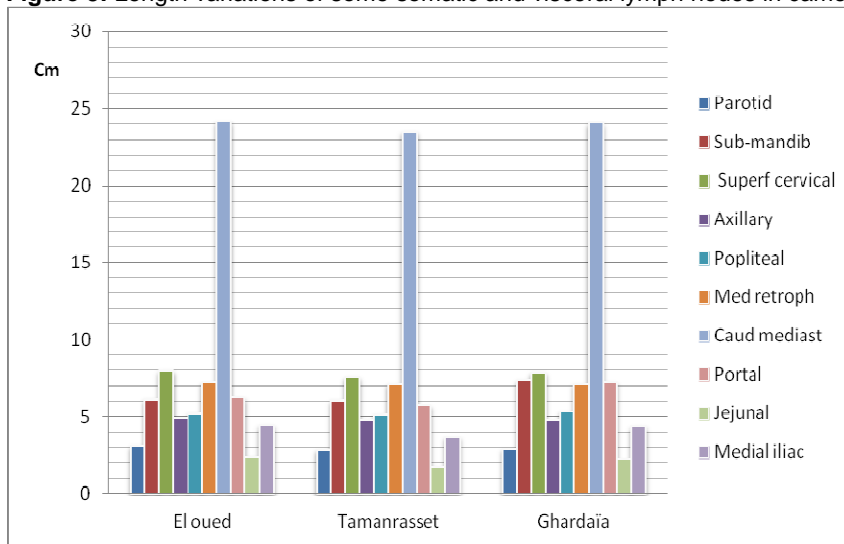
width. The weight situated between  $7.29 \pm 0.349$  g and  $08.79 \pm 0.358$  g, while the mass ration ranges were  $0.04 \pm 0.001\%$  and  $0.043 \pm 0.001$  %. Sub mandibular situated on each side, in the angle of the mandible, near the salivary gland. They drain the tongue and the anterior half of the head to flow after that in the retro pharyngeal lymph.

One of the major lymph node is the auxiliary, it is constant, more or less flattened and circular shape, measures were:  $4.76 \pm 0.253$  cm to  $4.92 \pm 0.273$  cm length and  $3.81 \pm 0.265$  cm to  $4.24 \pm 0.241$  cm width, weighing between  $5.35 \pm 0.477$  g and  $6.64 \pm 0.527$  g, mass ratio were  $0.028 \pm 0.001\%$  and  $0.039 \pm 0,001\%$ . It is located at the intern face of the shoulder, in connective and adipose tissue, at the height of the muscle of the third dimension on the chest and serratus muscle below the axillary vein. Either on the intern faces of the shoulder on rib wall. The last node studied was the popliteal lymph node, their measures were:  $5.11 \pm 0.507$  to  $5.32 \pm 0.495$  cm lengths and  $4.16 \pm 0.496$  cm to  $4.36 \pm 0.317$  cm width. Weighs range between  $6.30 \pm 0.313$  g and  $07.67 \pm 0.487$  g, while mass ratio balance between  $0.038 \pm 0.001\%$  and  $0.049 \pm 0.001\%$ . It is unique,

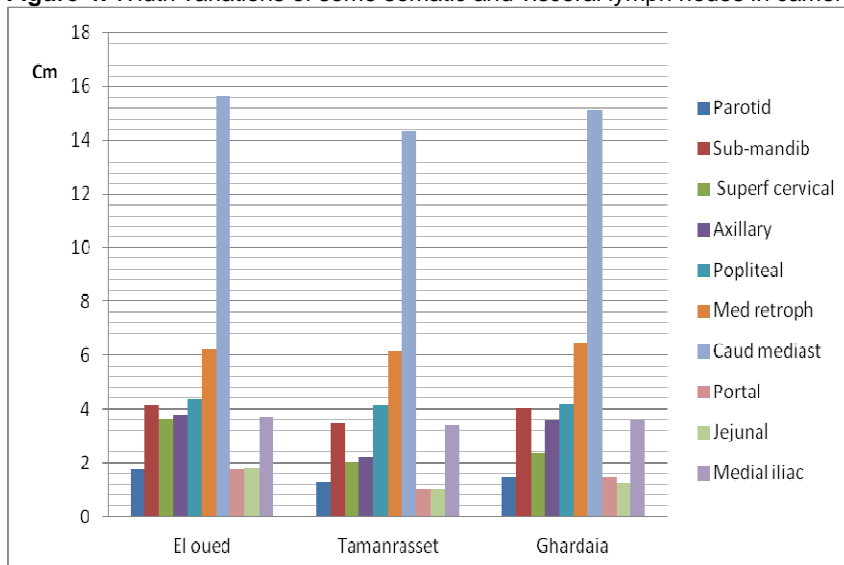
**Table 1:** Absolute and ratio mass values of some visceral and somatic lymph node in Chambi, Ouled Sidi echikh and Tuareg camels

		Zone 1: Eloued		Zone 2: Tamanrasset		Zone 3 : Ghardaia	
		Absolute mass, g	Mass ratio, %	Absolute mass, g	Mass ratio, %	Absolute mass, g	Mass ratio, %
Somatic Lym. nodes	Parotid	4.13±0.298	0.022±0.001	3.26±0.406	0.031±0.001	03.96±0.228	0.019±0.001
	Sub-mandibular	7.42±0.470	0.04±0.001	7.29±0.349	0.054±0.001	08.79±0.358	0.043±0.001
	The superficial Cervical	7.89±0.359	0.043±0.001	7.13±0.359	0.053±0.003	7.52±0.342	0.037±0.002
	Axillary	6.64±0.527	0.036±0.001	5.35±0.477	0.039±0.001	05.71±0.352	0.028±0.001
	Popliteal	7.30±0.313	0.04±0.001	6.68±0.313	0.049±0.001	07.67±0.487	0.038±0.001
Visceral Lym. nodes	The medial retropharyngeal	09.77±0.237	0.053±0.002	09.01±0.407	0.066±0.002	09.54±0.406	0.047±0.002
	Caudal mediastinal	16.63±0.590	0.091±0.002	12.77±0.426	0.094±0.001	15.99±0.515	0.079±0.001
	Portal	07.62±0.365	0.041±0.001	06.74±0.224	0.05±0.001	08.11±0.441	0.04±0.001
	Jéjunal	04.74±0.331	0.026±0.001	04.16±0.369	0.030±0.001	04.32±0.559	0.021±0.001
	The medial iliac	06.47±0.485	0.025±0.001	05.67±0.414	0.042±0.001	06.39±0.295	0.031±0.001

**Figure 3:** Length variations of some somatic and visceral lymph nodes in camel



**Figure 4:** Width variations of some somatic and visceral lymph nodes in camel



constant and ovoid. It has oval shape, located slightly above the tarsal joint and covered with tendons that form the Achilles. It drains the hind limb to flow in the ilio-femoral lymph nodes.

For visceral lymph nodes was observed, the highest node is the caudal mediastinal lymph node, this dimension were 23.49±0.361 cm to 24.13±0.426 cm length and 14.13±0.305 cm to 15.66±0.265 cm width, and weighing average: 12.77±0.426 g to 15.99±0.515 g, the mass ratio fluctuate between 0.079±0.001% to 0.094±0.001%. It is always constant lymph node, unique and voluminous, which located in the caudal mediastinum on the lateral-dorsal surface of the esophagus and the ventral surface of the caudal thoracic aorta, reaches the tenth thoracic vertebra, but due to the large size of some animals may be up to the first lumbar vertebra.

The following nodes (medial retropharyngeal) are very large lymph node measuring 7.12±0.526 cm to 7.23±0.217 cm length and 6.16±0.523 cm to 6.46±0.317 cm width, and weighing between: 9.01±9.77 g and 09.54±0.406 g, which further has ratio mass 0.047±0.002% and 0.066±0.002%. It's carved by the gutter, which receives the common carotid artery. It is in relation to the mandibular gland and dorsal surface with occipital artery. They drain the base of the tongue, larynx, pharynx, and the posterior half of the head, to flow finally in the pre-atloïdien nodes.

The smallest visceral lymph node observed is jejunal lymph nodes, sizes were: 1.69 ± 0.522 to 2.41±0.269 cm length and 1.03±0.337 cm to 1.78±0.245 cm width, weigh balance between 04.16±0.369 g to 04.74±0.331 g, with mass ratio: 0.021±0.001% and 0.030±0.001%.

The Jejunum Lymph nodes are the most numerous among the nodes of the abdominal cavity of camels. These groups of lymph nodes have round or oval shapes, located along the attachment of the mesentery of the intestine. It was noted that the portal lymph nodes are found in the binding site of the small gland in the throat, around the portal vein. It is partially hidden in the pancreas and they are 4 in number, the size varies between: 5.75±0.146 cm to 7.25±0.338 cm length and 1.04±0.105 cm to 1.76±0.125 cm width, whereas the weighs rage between: 06.74± 0.224 g to 08.11±0.441 g, mass ratio may achieve 0.04±0.001% and 0.05±0.001%. These nodes were located in the attachment of the lesser omentum, and hidden by the pancreas party.

Among the nodes studied, were quoted the internal iliac lymph nodes. It consists of two sets (large and small). The nodes are hubs of the hindquarter measuring: 3.67±0.213 cm to 4.44± 0.243 cm length and 3.41±0.357 cm to 3.69±0.330 cm width, and weighing about: 05.67± 0.414 g and 06.47±0.485 g, the mass ratio between: 0.025±0.001% to 0.042±0.001%. Situated on the rising branch of the ileum, ahead of the entry of the pelvis to the surface of the head of the psoas. They drain the pelvic organs, female genital tract, ovaries, flank, peritoneum, and the gluteal region.

The results obtained in our study suggest that the topography of camel's lymph nodes examined (*Camelus dromedarius*) is generally the same in cattle (Анатомія свійських тварин, 2001; Цюнская, 1965). Some differences affect the medial retropharyngeal lymph nodes. These nodes are connected to the head and neck of this species of mammals. Consequently, the lymph nodes are not located on the dorsal wall of the pharynx, as in other mammals, but its latero-ventral surface in the cranial division of the cervical region. Some author indicates the similarity of the macroscopic structure of the lymph nodes of camel with the relevant domestic pigs, these lymph nodes are also formed as a result the consolidations of separate small units.

However, it should be noted that the degree of fusion of nodes in a single organ of pig is more expressed, in consequence of which they greater resemble to tuberos conglomerations, than congregate, which is characteristic for the lymph nodes of camel (Тішкіна, 2007; Гаврилин et al., 2007).

We also know that because of the special arrangement of the efferent lymph nodes and lymph movement in pigs occurs in the "opposite" direction from the portal sinus to the boundary (Тішкіна, 2007). The data about the nature of the dynamic of lymph in the nodes of the camel are contradictory. Information about the fact that the bearing and efferent lymphatic vessels in the lymph nodes of camel were found in one and the same section of their capsule, on the convex surface of nodes, will not be coordinated with the current ideas brought by (Taher et al., 1979); and (Soliman and Mazher, 2005). About the principles of the circulation of lymph in the organism of mammals and require conducting the additional studies.

The linear characteristics of the lymph nodes of camel (*Camelus dromedarius*) mostly vary in

the same limits, as the lymph nodes of cattle with an appropriate body weight, the result agree with (Гаврилін, 2000). According to the data of (Шура, 1965), some visceral lymph nodes of camel (caudal mediastinal, medial iliac) are developed to greater extent, which is probably caused by the higher degree of the functional activity of unites under the conditions of the living environment of characteristic for the dromedaries.

### Research Highlights

1. The camel race has no effect on the parameters of measurement of the lymph nodes, virtually all of the parameters obtained in direct relation with the age of the animal.
2. We need to establish normal values of all the lymph nodes and the dimensions of the components to determine and reveal the perfect shape of each organ.
3. Must have more efforts and cooperation between researchers, for more results concerning the camelid world. The animal remains an important preoccupation, especially economically, in the Arab world.

### Limitations

The main limitation of this study is the lack of publication and work in this area of research, which allows us to not make a scientific comparison to get more results.

### Recommendations

The researchers recommend the continuation of their studies on a multidisciplinary study on the histology, to allow having a molecular aspect with accuracy and topography of the lymph nodes of different breeds of local camels from birth until maturity.

### Funding and Policy Aspects

This study was necessary to highlight the characteristics of camel's lymph nodes and differences between the local breeds, and to establish their final shape.

### Conclusions

The lymph nodes of dromedary (*Camelus dromedarius*) according to their topography and linear characteristics in general correspond to the similar nodes of cattle and macroscopic structure - they occupy the intermediate position between the corresponding lymphatic organs of horse and pig. Macroscopically, the lymph nodes of

camel congregate; they are partially fused, structural-functional units (small units) without evidence of the specific attitude.

### Authors' Contribution and Competing Interests

1. Gavrylin Pavlo wrote the result, discussion and revising the manuscript.
2. Rahmoun Djallal Eddine collected the lymph nodes and wrote the first draft
3. Lieshchova Marina made the morphometric measurements and shared in writing and revising the manuscript.

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