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Descriptive Anatomy of Masseter Muscle in Maned Wolf (*Chrysocyon Brachyurus* - ILLIGER, 1815)

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Abstract— *The present study is a descriptive and comparative research of masseter muscle in Maned Wolf, involving dissection, analysis and discussion with domestic dog, relatively, well established. For this, two adult specimens, with no defined age, were used under usual techniques of preparation and dissection in anatomy. In this sense, this work shows that masseter muscle in Maned Wolf is rectangular oblique, dorsal to ventral and rostral to caudal, on lateral side of head and ventrally to the ear, extending from ventral border of zygomatic arch to mandible. In summary, the results reveal that there is a basic anatomical pattern similar to domestic Dog, differentiating its rectangular shape and number of layers. However, this study showed unprecedented characteristic and differences inherent to each species, especially those related to their size and eating habits.*
Keywords— ***Wild Animals, Masticatory Muscles, Dissecation and Cerrado Biome.***

I. INTRODUCTION

Maned Wolf (Chrysocyon brachyurus - ILLIGER, 1815) belongs Chordata phylum, Carnivorous order, Mamalia class and Canidae family, weighs between 20 and 23 kg, between 145 and 190 cm in length and approximately 80 cm in height. This animal has solitary habit, approaching another animal of the same species in times of reproduction. Their food habit is omnivorous, but preferentially feed fruits, reptiles, insects, small vertebrates and eventually large vertebrates **[1,2,3]**.

Its habitat comprises, mainly, Cerrado, considered a mosaic of phytophysiognomies, due its varied characteristics, including forest, savanna and country **[4,5,6]**, and also found in other areas, such as eastern slope of Serra do Espinhaço (MG), Serra da Mantiqueira, in the south and in the states of Rio de Janeiro, São Paulo and Minas Gerais **[1,3]** . The survival of this species is significantly threatened by loss of habitat for agricultural activities, motivated by food competition or disease transmission **[1,6]**.

The understanding of its biological system and correlation with components of biome that it is inserted is essential information for its conservation, which can be evidenced in comparative anatomical study. Is relevant consider that anatomy is the science that studies structural composition of living beings, and it is possible to observe eventual morphofunctional alterations in phylogenetically close taxonomic groups, associated with behavior and adaptations of food, reproduction and survival in environments that no longer retain their originality, in face of unavoidable human intervention **[7,8,9]**.

Masticatory effectiveness of mammals is fundamental for their survival, considering that main role is essential in their feeding, so anatomical study of mastication muscles, especially Masseter muscle in Lobo-Guará, becomes relevant, since could be evidenced that this

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muscular group develops from muscular action allied to mechanics of skull, besides mastication muscles adaptations, according to dental morphology. Thus, each species may present anatomical differences, considering that masticatory pattern of each species is different **[14] [10,11]**.

Anatomical, topographical and/or systemic descriptions of species are fundamental for biological system knowledge and veterinary clinical practice **[12]**. However, in view of great importance of wild animal's anatomy for biome eco-sustainability, the anatomy of Maned Wolf is little studied. Considering that muscular system is related to important functions, such locomotion and animal feeding, studies related to this subject are of great value. Therefore the objective of this work was to investigate and describe the anatomy of Masseter Muscle in Maned Wolf (Chrysocyon brachyurus - ILLIGER, 1815), as a literary subsidy for different areas of knowledge.

II. MATERIAL AND METHODS

The present paper is a descriptive and comparative anatomical study with one male and one female specimen of Lobo-Guará (*Chrysocyonbrachyurus*), obtained from accidental death on the roadsides of Brazilian Southeast of Goiás, under authorization of SISBIO nº 37072-2. Considering the descriptive approach of this work, statistical analysis is not necessary. All procedures were conducted in accordance with ethical principles and were approved by the Institutional Ethics in Research Committee at the Federal University of Uberlândia (CEUA/UFU nº 067/12).

The study was made in the research laboratory of human and comparative anatomy from the Federal University of Goiás – RC, where the skin head and neck was removed with scissors, scalpel and anatomical tweezers. The adipose tissue of face and epicranium were removed using tweezers and scalpel and muscles of the face and neck were dissected using tweezers, scalpel and scissors and each part of muscle is carefully removed and measured using a precision caliper and weighed.Subsequently, was made a fixation with aqueous 10 % formaldehyde solution to conservation andperformed under consecrated techniques in Macroscopic Anatomy.

A Sony Cyber® digital camera was used to the photographical documentation and the description nomenclature adopted is the standard of *Nomina Anatomica Veterinaria* (**2017**) **[13]** , elaborated by the International Committee on Veterinary Gross Anatomical Nomenclature.

III. RESULTS

Masseter muscle of Maned Wolf is approximately rectangular in shape and obliquely disposed, dorsal to ventral and rostral to caudal, on lateral face of the head, ventrally to ear and extends from ventral border of zygomatic arch to mandible. Seen from lateral face, said muscle is totally covered by an aponeurosis, thicker near the angle of mouth (Fig 1, d).

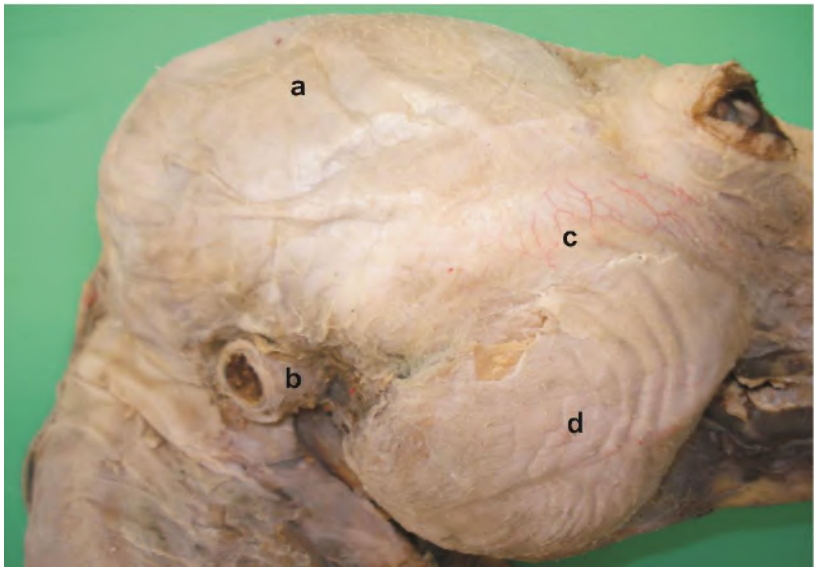

Fig.1: Side view demonstrating aponeurosis of coating on chewing muscles. a - M. Temporal; b- Auditory pavilion; c- Zygomatic arch; d- M. Masseter with aponeurosis.

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Once aponeurosis removed, is observed that muscle fascicles are not clearly visible, although small facial septa can be seen, in order to identify the direction of fibers. Even under rough observation, it is observed that its masseter is composed of several parts, which are identified by variable direction of their fibers (Fig 2, c, f).

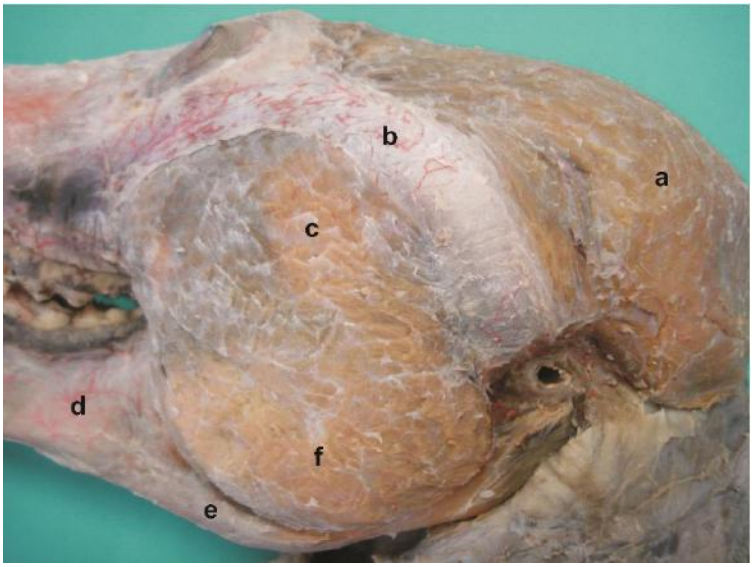

Fig.2: Side view demonstrating mastication muscles after removal of aponeurosis coating. a- M. temporal; b- Zygomatic arch; c- Zygomatic part of Masseter; d- Jaw; e- Digastric; f- Mandibular part of Masseter.

Initially, four constituent parts of Masseter muscle are identified: Superficial, Rostral, Middle, and Deep. The superficial part is larger, and extends throughout the muscle surface, its fibers can be grouped in a dorsorostral or zygomatic and another ventrocaudal or mandibular, separated by a relatively thick fascia (Fig 3- c, d). The zygomatic belly is thin, laminar in appearance and its fibers are approximately vertical in direction, while mandibular ventricle is very thick, bulky, whose fibers are oblique from rostral to caudal and ventrally.

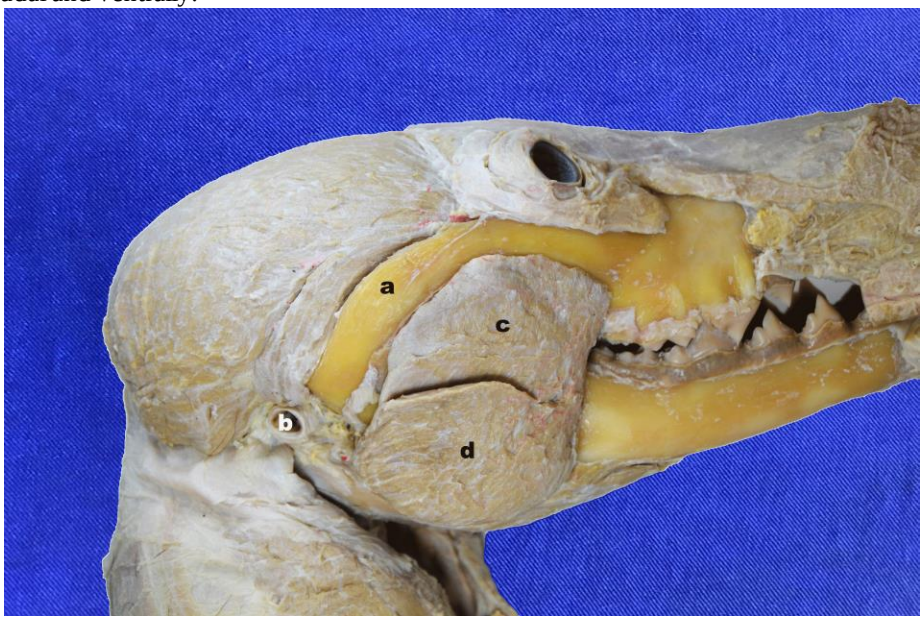

Fig.3: Side view showing wombs of Masseter. a- Zygomatic arch; b- Auditory pavilion; c- Zygomatic womb of Masseter; d- Mandibular womb of Masseter.

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The fibers of zygomatic belly originate along ventral border of zygomatic arch, deepening as they distant from origin, penetrating under mandibular womb, and inserting, through a long aponeurosis, into lateral surface of the angle of mandible, deeply to mandibular ventricle. The fibers of mandibular womb originate from superficial aponeurosis and fascia that separate it from zygomatic womb. As it approaches mandible, the mandibular ventricle becomes thicker and thicker until its apparently fleshy insertion into lateral surface of branch, the angle, caudal part of mandibular body, as well as angular process of mandible. In view of its great volume, ventral border of mandibular ventricle of Masseter muscle protrudes beyond mandibular border, producing a deep mark in the ventricle of Digastric muscle (Fig. 4).

Fig.4: Side view demonstrating the relationship between mandibular ventricle of Masseter muscle with Digastric muscle. a- Zygomatic arch; b- Auditory pavilion; c- Zygomatic womb of Masseter; d- Mandibular womb of Masseter; e. Digastric.

Deeply, the mandibular womb is separated from zygomatic womb by a relatively thick fascia, mainly in its caudoventral part.

Once superficial part is removed, the Mean and Rostral parts of Masseter muscle are exposed (Fig. 5 - c, d). The Rostral part of Masseter muscle is the smallest of them. It is narrow and long, displaying approximately rectangular shape, arranged almost vertically, behind angle of mouth. Its origin occurs on the lateral side of maxillary process of the zygomatic bone as well as zygomatic process of maxillary bone. The fibers follow in ventral direction, slightly inclined from rostral to caudal, and are inserted in the side face of caudal part of mandible body. Its surface face is covered up by the Masseter muscle, except at its rostral border which is covered by the same aponeurosis that covers surface. The deep fibers of Rostral part mix with the middle part's rostral fibers almost everywhere, except close to mandibular insert when they are clearly separated by a relatively thick fascia (Fig. 5-d).

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Fig.5: Side view demonstrating portions of Middle Part of Masseter and its caudal and rostral fascicles. a - Zygomatic arch; b- Deep part of Masseter; c- Rostral Fascicle of Middle Part of Masseter; d- Caudal fascia of middle part of Masseter; e - Top part folded from Masseter.

The middle part of Masseter muscle is smaller than superficial part, it exhibits fan form. Its origin occurs at ventral border of zygomatic bone, but soon divides into two fascicles, a more superficially localized caudal fascicle, which is inserted in the middle part of ventral border of masseterine fossa, and a deeper one, the rostral fasciculus, which inserts on the same edge, rostrally to superficial part (Fig. 5 - d, c). Next to origin the fibers of two fascicles are mixed and confused, as well the fibers of Deep Part.

The insertion of superficial, middle and rostral parts of masseter muscle occurs on lateral surface of mandible, rostrally at the angle and angular process of mandible. Once the Middle Part of Masseter muscle is removed, the Deep Part of Masseter muscle is exposed, which is relatively narrow but thick. It is the most caudal of parts, presenting origin along ventral border of caudal half of zygomatic arch, from where it follows slightly inclined ventrorostrally, towards ventral edge of masseterina fossa.

Its superficial fascicles are inserted through a thick aponeurosis, but most of its fibers have fleshy insertion on the floor of masseterine fossa. Along entire length of the muscle, superficial fascicles are separated from deep ones by a thick aponeurosis, which extends from zygomatic arch to ventral border of masseterine fossa (Figs 7 and 8-b, d).

Although the direction of fascicles that make up Masseter muscle of Maned Wolf allows identification of four or more parts, none of them can be clearly visualized, in all its extension, since fascicles are only separated by thin and irregular ones connective septa. Thus, observing muscle as a whole one perceives that its parts are relatively mixed, mainly close to its origin, forming a muscular "syncytium".

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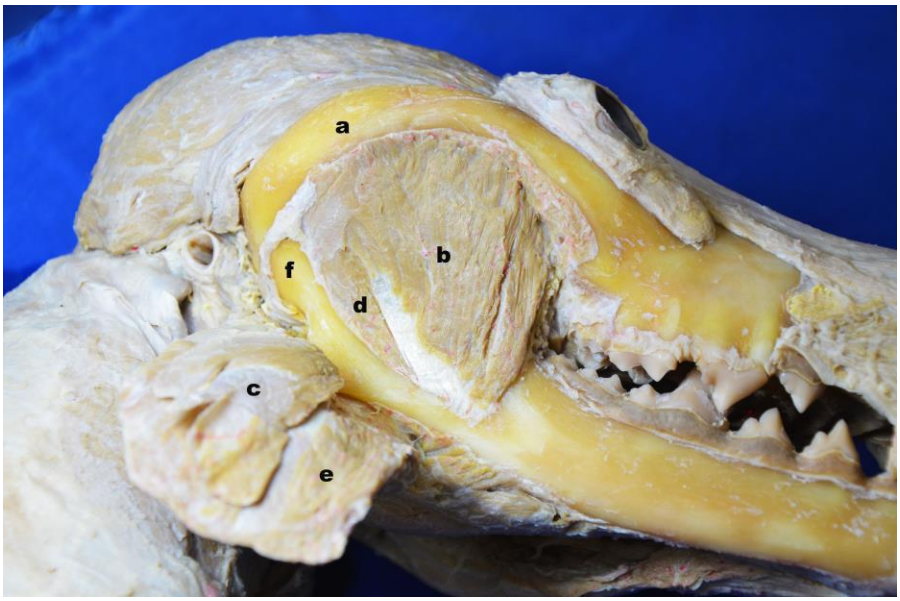

Fig.7: Side view demonstrating muscles of Deep Part of Masseter. a- Zygomatic arch; b- Surface facets of deep part of Masseter; c- Average part of Masseter d- Deep fascias of Masseter; e- Masseter; f - Joint process of mandible.

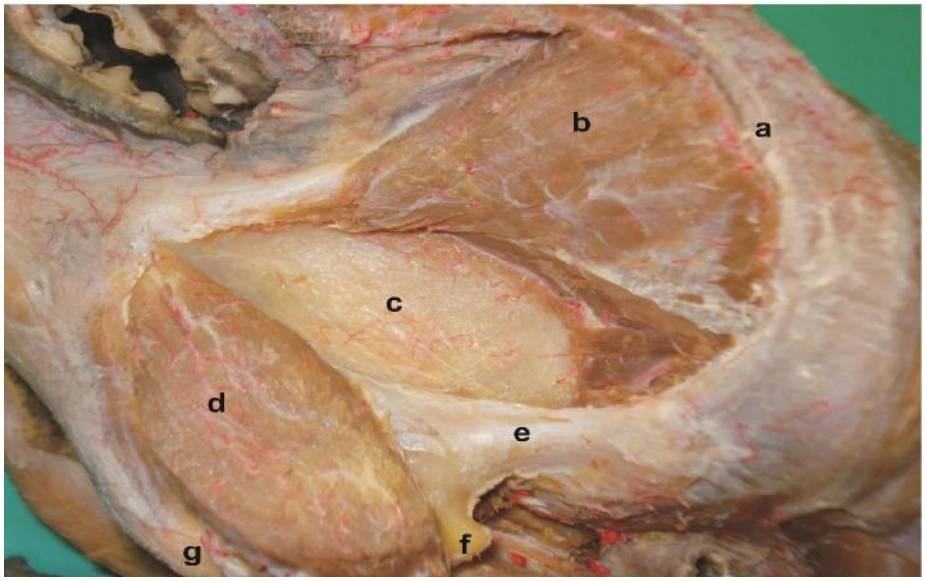

Fig.8: Side view demonstrating muscles of Deep Part of Masseter and fossa masseterina. a- Zygomatic arch; b- Surface facets of deep part of Masseter; c- Masseterine fossa; d- Deep fascicles of Masseter; e- Articular process of mandible; f- Angular process of mandible; g- Digastric muscle.

IV. DISCUSSION

Annotations in Maned Wolf, partially corroborates wit descriptions of Turnbull (1970) **[14]** in wild mammals and Miller et al. (1964) **[15]** , in Dog, regarding the existence of an aponeurosis covering the muscle, its origin in zygomatic arch and its insertion in mandible. Regarding the shape of muscle, a significant difference is observed, and mammalian muscle presents a relatively triangular shape in the description of Turnbull (1970) **[14]**; in the Maned Wolf, masseter muscle with a rectangular shape is already present.

Miller et al. (1964) **[15]** refers to dog masseter muscle presenting three parts, dividing them into Superficial, Middle and Deep. Turnbull (1970) **[14]**

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describes the presence of two parts in mammals, being Superficial and Deep. In Maned Wolf, the presence of four parts is observed: superficial, middle, deep and one that is distinguished from the others, the rostral part. In Maned Wolf a similarity is observed, as to the size of superficial part, in relation to Miller et al. (1964) **[15]**, in dogs when classified this, as the largest of parts of the muscle, having its origin in rostral half of zygomatic arch and being inserted mostly in mandible, in its ventrolateral face and a smaller one below the tympanic bulla.

In spite of this similarity, Maned Wolf there is a division of this part where we can observe fibers arranged in different directions and the existence of a thick fascia that separate them in the caudoventral part. Therefore, they were classified as, zygomatic belly having approximately vertical fibers and mandibular ventricle with oblique fibers in direction of the face. When these two parts meet rostrally there is a mixture between the fibers.

The second part found in Maned Wolf masseter muscle, called Rostral, which was not found in descriptions of dog Masseter muscle, so little of other mammals, is the smallest in relation to other three parts. It originates in maxillary process of zygomatic bone, is disposed vertically posterior to the angle of mouth and inserts in lateral face of caudal part of mandible body. Their deepest fibers are mixed with middle-layered fibers of middle layer, and there is no distinction between them, even close to mandible where they are separated by a thick fascia.

Middle part of Maned Wolf Masseter resembles middle layer described by Miller et al. (1964) **[15]**, in dog, originating from zygomatic arch and its fibers following in ventral direction inserting in masseterina fossa, observing variations in some species which have insertion in anteroventral margin of masseterina fossa. In Maned Wolf the Middle Part is fan-shaped and also presents origin in zygomatic arch, but it is divided into two fascicles, the first being more superficial, caudal fascicle and the second, deepest and rostral fasciculus.

The observations on caudal fascicle agree better with description in dog made by Miller et al. (1964) **[15]**, since it inserts in middle part of ventral margin in masseterina fossa, rostrally inserting rostral fasciculus in the same margin.

Miller et al. (1964) **[15]** describe little about last layer in deep part, because the impossibility of visualizing its origin motivated by mixing of fibers with those of Temporal muscle. In Maned Wolf was not possible identify it clearly, originating in caudal half of zygomatic arch and its fibers follow ventro-rostrally inclined, until insertion in masseterina fossa. Miller et al. (1964) **[15]** describe their insertion with most of fibers at the back of masseterine fossa, while a smaller group is inserted into anterior end of the fossa. In Maned Wolf it was possible to observe the existence of superficial fascicles that are inserted through aponeurosis, and deeper fascicles with fleshy insertion.

V. CONCLUSION

The basic anatomical pattern of Masseter muscle in Maned Wolf is similar to other mammals of similar habit, however, this study possibility observe differences inherent to species, such the arrangement of Masseter muscle with rectangular shape, the presence of four parts, and existence of superficial fascicles that insert through aponeurosis and deeper fascicles with fleshy insertion. Thus, with this descriptive anatomical study, the knowledge of Masseter muscle in Maned Wolf is unprecedented, contributing to the understanding of this group of muscles that is essential for survival, and showed particularities that influence in its biological system, behavior and importance in ecosystem.

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