Dept. of Anatomy and Histology,
Fac. Vet. Med., Assiut University,
Head of Dept. Prof. Dr. A. Hifny.

COMPARATIVE ANATOMICAL STUDIES ON THE MUSCLES OF PROPULSION ONTHE LATERAL AND CRANIAL ASPECTS OF THE HIP AND THIGH IN RABBIT AND CAT

(With 2 Tables and 13 Figures)

By

I.A. IBRAHIM

(Received at 7/1/1992)

دراسات تشريحية مقارنة على العضلات الدافعة الوحشية
والأمامية للكفل والفخذ في الأرانب والقطـــط

اسماعيل ابراهيـم

لإختلاف نوع الحركة في الأرانب عنها في القطط فلقد أجريت هذه الدراســة لغرض توضيح الصفات التشريحية للعضلات الدافعة الوحشية والأمامية للكفـل والفخــذ باستخدام عشرة أرجل حوضية لكل منهما بغض النظر عن الجنس والعمر حيث تم تشريـح العينات بالطرق التشريحية المعتادة بعد حقنها بمحلول الفورمالين ١٠٪ · ولقـــد استهدفت هذه الدراسة توضيح شكل ومنشأ واندغام كل عضلة من هذه العضلات وكذلـك علاقتها بالتراكيب المحيطة بها · ولقد أظهرت الدراسة بعض الفروق التشريحية لهذه العضلات في كلا النوعين وتمت مقارنة النتائج المستحصلة مع نتائج الأبحاث المعمولـة في حيوانات أخري ·

SUMMARY

The origin, insertion, structure and relations of the muscles of propulsion on the lateral and cranial aspects of the thigh in both rabbit and cat were completely described. The obtained results were compared with those reported in other animals.

INTRODUCTION

The pelvic limb serves mainly to propel the body forwards. The following muscles are especially important in this forwards propulsion. The gluteus (which extends the hip), the quadriceps femoris (which extends the stifle), the triceps surae (which extends the hock), the tensor fasciae latae and biceps femoris muscles as well as the superficial and deep flexors of the digits. As the mode of locomotion in rabbit and cat differs completely, the before mentioned muscles in both animals differ sufficiently to warrant separated description. EL-SHARABY (1990) in his study on the muscles forming the calcaneal tendon in some of the domestic animals, gave a detailed description on the triceps surae and the flexors in the rabbit. On the other hand, HARRISON (1962) and WALKER (1970) gave a brief study on the muscles of the thoracic and pelvic limbs in cat as well as rabbit and cat respectively. In the present study the already knwon

data on the muscles of propulsion on the lateral and cranial aspects of the hip and thigh in both rabbit and cat have been completed.

MATERIAL and METHODS

The present study was carried out on ten pelvic limbs of each adult rabbits and cats of nearly the same size and of both sexes and of different ages. The examined animals were anaesthetized by chloroform and bled through the common carotid artery then injected with 10% formalin solution. The dissection of the limbs was carried out after three days to examine the origin, insertion, structure and relations of the muscles of propulsion on the hip and thigh regions. Certain biometric measurements including the relation of the length and weight of these muscles to that of the femur were taken as these measurements play an important role in mode of locomotion of the animals studied.

The nomonclature used was that adopted by the N.A.V. (1983).

RESULTS

I- Lateral muscles of the hip and thigh:

M. tensor fasciae latae (Fig. 1, 2, 3, 4/4):

In rabbit, the M. tensor fasciae latae (Fig. 1, 3/1) is elongated fan-shape which covers the cranio-medio-lateral aspect of the thigh where it appears from the lateral as well as the medial sides. It forms an envelope which covers partially the M. quadriceps femoris and the femur medially, laterally and cranially. The muscle originates by a narrow fleshy tendon from the ventral border of the most cranial part of the crest of the ilium cranial to the origin of the superficial and middle gluteal muscles. The fleshy part of the muscle is thick cranially and thin caudally and its fibers are directed distocaudally. It descends for about 10 cm before its reduction to the broad heavy fascia latae throughout its distal third where it inserts into the patella and the tibia. The M.tensor fsciae latae is related laterally to the superficial gluteal muscle proximally and the M.biceps femoris distally, medially to the sartorius cranially and vastus lateralis caudally.

In cat, the M.tensor fasciae latae (Fig. 2, 4/1) is roughly triangular in shape and appears completely laterally. The muscle cannot be seen from the medial aspect. It originates by a thick fleshy tendon from the ventral border of the crest of the ilium cranial to the origin of the deep gluteal muscle and ventro-caudal to the origin of the M. sartorius. The fleshy part of the muscle descends for about 4 cm and reduced to the heavy fascia latae throughout its distal 2/3 to be inserted into the lateral surface of the femur and on the tibia.

M. biceps femoris (Fig. 1, 2, 3, 4/5):

In rabbit, the M.biceps femoris is the largest and heaviest of the muscles of the lateral aspect of the thigh. It is elongated, nearly quarilateral in outline and arises by two unequal completely separated heads, a cranial vertebral (sacral) head and a

caudal pelvic (ischiatic) head.

The vertebral (sacral) head (Fig. 1/5') is roughly triangular in shape with its broad base proximally situated. It arises by a broad origin from the spinous processes of the last four sacral vertebrae, lateral border of the sacrum as well as the ventrocaudal end of the sacrotuberal ligament in addition to the aponeurosis which covers the M. longissimus dorsi cranially. The muscle fibers diverge distally in a long tendinous tendon which inserts into the patella.

The pelvic (ischiatic) head (Fig. 1/5", 3/5) has a relatively narrow origin which arises from the tuber ischii proximal to the origin of the M.semitendinosus. The muscle ends by a broad aponeurotic insertion into the patella as well as the straight patellar ligament, tibial tuberosity and the crural fascia. The M. biceps femoris is about 2.5 cm width at its proximal part, 3 cm at its middle and 5 cm at its distal part.

In cat, the M.biceps femoris (Fig. 2, 4/5) is large and powerful which covers most of the lateral aspect of the thigh. It is about 2 cm at its proximal part, 4 cm at the middle and 6 cm at the distal part. The muscle originates by a single narrow head from the ischial tuberosity cranial and proximal to the origin of the M. semitendinosus. The muscle ends by a broad aponeurotic insertion that extends from the patella to the middle of the shaft of the tibia.

Gluteus :

In rabbit and cat, the gluteus forms a lateral triangular muscular mass which lies on the dorsal surface of the sacrum between the M.tensor fasciae latae cranially and the M.biceps femoris caudally. This muscular mass is well developed in rabbit than cat. In both animals it consists of the Mm. gluteus superficialis, gluteus medius and gluteus profundus.

M. gluteus superficialis (Fig. 1, 2, 3 / 2; 7, 8/4):

The superficial gluteal muscle in the rabbit (Fig. 1, 3/2; 7/4) is a V-shape in outline, the limbs of which, cranioventral and caudodorsal, represent its origin.

The cranioventral limb (portion) is partially fused with the M. tensor fasciae latae. It arises from the gluteal fascia and the cranial border of the crest of the ilium as well as the ventral border of its most cranial part caudodorsal to the origin of the M. tensor fasciae latae.

The caudodorsal limb (portion) is partially covered by the vertebral head of the M. biceps femoris. It arises from the gluteal fascia and indirectly from the spines of the first three sacral vertebrae.

The muscle fibers of the two limbs (portions) converge distally and pass over the greater trochanter of the femur. Here, they unite with the caudal digitations of the M. tensor fasciae latae distal to the hip joint to be inserted into the third trochanter of the femur. The muscle is about 6 cm in length and 3 cm width at its most

widest part while 0.5 cm width at its insertion.

In cat, the superficial gluteal muscle (Fig. 2/3, 8/1) is the most caudal of the gluteal group. It is relatively small, flat and rectangular in outline. It lies caudal and partially superficial to the M. gluteus medius. The muscle is about 1.5 cm in width and 5 cm in length. It arises from the spinous processes and the lateral borders of the last two sacral and the first caudal vertebrae. The muscle fibers extend ventro-laterally between the Mm. gluteus medius and tensor fasciae latae cranially and the M. biceps femoris caudally to be inserted in the lateral surface of the femur distal to the greater trochanter as well as the fascia latae.

M. gluteus medius: (Fig. 1, 2, 3, 4/3; 7, 8/1):

In the rabbit, the middle gluteal muscle (Fig. 1, 3/3; 7/1) is the broadest of the gluteal group. It lies between and partially covered by the two limbs of the superficial gluteal muscle. It arises from the edge of the cranial border and adjacent part ofthe lateral surface of the crest of the ilium. The muscle fibers pass caudo-ventrally to be inserted into the lateral aspect of the summit of the greater trochanter of the femur and a distinct line between it and the convexity. The muscle is about 0.5 cm thick at its origin and 0.2 cm thick at its insertion. Its widest part is about 4 cm and its narrowest part is about 2 cm while it is about 5 cm in length.

In the cat, the middle gluteal muscle (Fig. 2, 4/3; 8/1) is the largest, broadest, thickest and powerful of the gluteal group. It is about twice the size of the superficial one. The muscle fibers arise from the proximal half of the gluteal surface of the ilium as well as its dorsal border. They pass caudally and laterally between the Mm. sartorius and tensor fasciae latae cranially as well as the muscle superficial gluteal caudally to be inserted on the lateral surface of the cranial part of the greater trochanter of the femur. The muscle is about 4 cm in length. Its widest part is about 5 cm and its narrowest part is 3 cm while it is about 0.5 cm thick along its length.

M. gluteus profundus (Fig. 1, 2, 3, 4/4; 7, 8/2):

In the rabbit, the deep gluteal muscle (Fig. 1, 3/4; 7/2) is the most thickest, strongest and powerful of the gluteal group. It is about 4-5 cm long, 2.5 cm at the widest part and 1 cm at the narrowest one while its thickness is about 0.5 cm. The muscle nearly covers and occupies all the gluteal surface of the ilium and arises from this surface as well as the dorsal and ventral borders of the cranial part of the ilium caudal to the origin of the Mm. tensor fasciae latae, superficial and middle gluteal. Additional fibers originate from the lateral border of the caudal half of the sacrum. The muscle fibers converge and pass cranio-ventrally to be inserted into the lateral aspect of the greater trochanter of the femur and in a line cranial to the insertion of the M. gluteus medius.

The deep gluteal muscle in the cat (Fig. 2, 4/4; 7/2) lies under the lateral edge of the middle gluteal muscle. It is usually cylindrical in shape of about 3 cm long and 0.4 cm thick. The most cranioventral border of the muscle is tendinous in structure

and arises from the distal 1/3 of the gluteal surface of the ilium as well as its ventral border and inserted on the lateral aspect of the caudal part of the greater trochanter of the femur as well as the ridge of the intertrochanteric fossa.

II- Cranial muscles of the hip and thigh:

M. quadriceps femoris:

This strong muscle extends between the pelvis and femur proximally and the patella as well as the tibia distally. It covers the femur cranially, laterally and medially. Distally it forms a tendon which includes the patella within it and ends on the crest of the tibia as the straight ligament of the patella. The M. quadriceps femoris in both rabbit and cat consists of the Mm. vastus lateralis, vastus intermedius, vastus medialis and rectus femoris.

M. vastus lateralis (Fig. 5, 6/1; 7, 8/3):

In rabbit, the M. vastus lateralis (Fig. 5/1, 7/3) is the largest and strongest division of the muscle quadriceps femoris. It covers partially the M. vastus intermedius and completely the M. rectus femoris laterally and lies between the M. tensor fasciae latae cranially and the Mm. biceps femoris and vastus intermedius caudally. It is about 9.5 cm long and 0.3 cm thick. Its fibers pass longitudinally proximodistally and arise from the edge of the greater trochanter of the femur and the adjacent area of the lateral surface of the femur between the greater and the third trochanter.

In cat, the M. vastus lateralis (Fig. 6/1, 8/3) lies under cover the M. tensor fasciae latae and caudal to the M. sartorius. It is the largest of the M. quadriceps femoris and the most lateral one. It covers completely the Mm. vastus intermedius and rectus femoris. The muscle is about 10 cm long and 0.5 cm thick. Its fibers pass longitudinally proximodistally and arise from the cranial border of the greater trochanter of the femur. It joins with other muscles of the group to be inserted on the lateral border and surface of the patella and in its straight ligament.

M. vastus intermedius (Fig. 5, 6/2; 7, 8, 9/5):

In rabbit, the M. vastus intermedius (Fig. 5/2; 7, 9/5) is a bipennate one with its fibers directed proximally. It lies between the M. vastus lateralis laterally, femur medially, biceps femoris caudally and the rectus femoris as well as the tensor fasciae latae cranially. The muscle is about 8.5 cm long and 0.2 cm thick and arises in common with the M. vastus lateralis from the edge of the convexity of the greater trochanter of the femur. It covers the lateral surface of the femur to a level distal to the 3rd trochanter then extends to overlap on its cranial and medial surfaces. In its distal fourth the muscle terminates by a tendon which attaches to the M. vastus lateralis.

In cat, the M. vastus intermedius (Fig. 6/2, 8/5) is the smallest of the quadriceps femoris. It is about 8.5 cm long and arises along the lateral and cranial surfaces of the femur to which it is adheres closely. Its fibers pass obliquely craniodistally and soon merge with the M. vastus medialis and the two muscles often appear as one mass.

M. vastus medialis (Fig. 9, 10, 11/6):

In rabbit, this muscle (Fig. 9, 11/6) is relatively thin. It is about 9 cm long and arises proximally from the intertrochantric fossa of the femur. Additional fibers arise from a line situated on the cranial surface of the proximal extremity of the femur between the greater trochanter and the head. The muscle fibers extend distally along the medial surface of the femur to which it is closely adherent. The muscle ends by a broad tendon which encloses a fibrocartilaginous disc before its attachment on the patella.

In cat, the M. vastus medialis (Fig. 10/6) lies caudal and medial to the M. rectus femoris and is covered medially by the M. sartorius where its fascia attaches to it. The muscle is originated from the medial and cranial surfaces of the femur distal to the head and inserted into the medialmargin of the patella. Its fibers merges with that of the M. vastus intermedius.

M. rectus femoris: (Fig. 3, 4/7; 5, 6/3):

In rabbit, the M. rectus femoris (Fig. 3/7, 5/3) is a bipennate one with its fibers directed distally. It lies between the Mm. vastus medialis, sartorius and tensor fasciae latae medially and cranially; Mm. vastus intermedius and biceps femoris caudally and the M. vastus lateralis laterally. It is about 10 cm long and 0.5 cm thick and arises by a short, strong tendon from an eminence infront of the acetabulum. It extends distally between the Mm. vastus lateralis and medialis to the patalla which is included in its strong tendon as a sesamoid bone. This tendon continues distally as the straight ligament of the patella. The M. rectus femoris is round in cross section distally while it is laterally compressed proximally.

In cat, the M. rectus femoris (Fig. 7/7, 6/3) is the most cranial one of the quadriceps group. It is uniform along its length and lies between the Mm. vastus lateralis and the sartorius. It is about 10 cm long and 0.5 cm thick and arises from a rough area near the ventral border of the shaft of the ilium infront of the acetabulum. Its fibers pass longitudinally proximo-distally to join the M. vastus lateralis in its distal part to be inserted with it into the medial border of the patella.

Distally, the quadriceps femoris muscle in both rabbit and cat forms a ligament which encloses the patella within it. It passes over the stifle joint to be inserted on the crest of the tibia as the straight ligament of the patella (Fig. 5, 6/4).

Concerning the relation of the length and weight of the muscles of propulsion to that of the femur Tables (1, 2) and Fig. (12, 13) show that, the Mm. biceps femoris and vastus lateralis are the heaviest ones in rabbit and cat followed by the M. tensor fasciae latae in rabbit and the M. rectus femoris in rabbit and cat. The deep gluteal muscle is relatively well developed in rabbit than cat. On the other hand, the M. vastus intermedius is the lightest one in rabbit and cat followed by the superficial gluteal and vastus medialis. Generally, the relative weight of each of the studied muscles show no characteristic variations as the development depends upon the mode of locomotion.

The M. tensor fasciae latae is the longest of the muscles of propulsion in both rabbit and cat but it is longer in rabbit than cat. Followed by the M. biceps femoris but it is longest in cat than in rabbit. The M. rectus femoris it is nearly the same in the studied animals. The gluteal muscles are the shortest of the studied muscles but they are shorter in cat than rabbit.

DISCUSSION

In the present study the M. tensor fasciae latae in rabbit is elongated fan shape and covers the cranial aspect of the thigh, while in cat the muscle is triangular in outline and appears only on the lateral aspect. In this respect the M. tensor fasciae latae of the rabbit resembles that described by WALKER (1970) in the same animal, MAY (1970) in sheep, McCLEOD (1960) is small and large ruminants, NICKEL, SCHUMMER, WILLE and WILKENS (1986) in domestic animals, GETTY (1975) in horse as well as SABER and AHMED (1987) in camel. However, the M. tensor fasciae latae in cat resembles that described by HARISON (1962) and WALKER (1970) in the same animal, MILLER, CHRISTENSEN and EVANS (1964) as well as GETTY (1975) in dog. The origin ofthis muscle from the cranial part of the crest of the ilium in both rabbit and cat gives more support to the muscle and its strength as described also in camel by SABER and AHMED (1987).

Concerning the origin of theM. biceps femoris, in rabbit, it is in accordance with that mentioned by WALKER (1970) and EL-SHARABY (1990) in the same animal, MAY (1970) in sheep, SABER and AHMED (1987) as well as SMUTS and BEZUIDEIHOUT (1987) in camel, RAGHAVAN and KACHROO (1964) and NICKEL et al. (1986) in cattle. However, the origin of this muscle in cat is in accordance with that mentioned by HARISON (1962) and WALKER (1970) in cat, MILLER et al. (1964) and GETTY (1975) in dog. On contrary, as mentioned by McCLURE. and GARRET (1973) in cat, the muscle has two heads of origin, ischiatic and vertebral. In rabbit, the belly of the M. biceps femoris is divided into two unequal completely separated parts which are in accordance with that mentioned in donkey by EL-SHARABY (1990), however he mentioned that the belly in rabbit is single and broad sheat which is in disagreement with that declaired in the present study. According to NICKEL et al. (1986) in cattle as well as SABER and AHMED (1987) in camel the belly is divided into two unequal parts which are completely separated. However, in cat, the belly is single and broad as in rabbit as mentioned by EL-SHARABY (1990). In dog asmentioned by SISSON (1975) and NICKEL et al. (1986) the belly is divided from the beginning into three parts named as superficial, intermediate and deep heads. On the other hand, in horse the belly is subdivided into three parts as mentioned by BRADLEY/GRAHAME (1946), GETTY (1975) and NICKEL et al. (1986).

In rabbit and cat, the gluteus consists of three muscles namely superficial, middle and deep gluteal muscles. In rabbit the superficial gluteal covers laterally the middle and deep ones while in cat it is the most caudal of the gluteal muscles. On the other hand, the middlegluteal muscle is well developed in cat than rabbit and the deep

gluteal is well developed in rabbit than cat. The superficial gluteal muscle is v-shape letter in rabbit and triangular in shape in cat. An additional origin from the sacrum for the middle gluteal muscle was shown in cat, while this origin was shown for the deep gluteal muscle in rabbit.

The M. rectus femoris in both rabbit and cat, is the longest head of the quadriceps femoris and arises only by one tendon from an eminence above and cranial to the acetabulum in rabbit and a rough area cranial to the acetabulum and near to the ventral border of the shaft of the ilium in cat. In rabbit the muscle is rounded in cross section distally and laterally compressed proximally, while in cat the muscle is rounded in cross section along its length. In sheep MAY (1970) also mentioned only one tendon of origin from a depression on the ventral border of the shaft of the ilium. However, in cattle as mentioned by GETTY (1975) the M. rectus femoris arises by two tendons from the Os coxae proximal and cranial to the acetabulum and from the ventral surface of the body of the ilium.

In rabbit and cat, the M. vastus lateralis is the largest broadest, strongest and heaviest division of the M. quadriceps femoris. In rabbit it covers partially the M. vastus intermedius and completely the M. rectus femoris while in cat it covers them completely.

The M. vastus intermedius arises in common with the M. vastus lateralis from the edge of the greater trochanter of the femur. In its distal part it terminates by a tendon which merges with the M. vastus lateralis. In cat the muscle mergos with the M. vastus medialis and the two appear as one muscle. In small and large ruminants the belly of M. vastus intermedius divides into two portions in the distal third of the femur and merge with the insertions of the medial and lateral vasti muscles respectively (MAY, 1970 and GETTY, 1975).

Table (1) and Fig. (12) showing that, the M. tensor fasciae latae is the longest of the muscles of propulsion under study in both rabbit and cat but it is longest in rabbit than cat. On the other hand, the gluteus are the shortest but they are shorter in cat than rabbit.

This study showed also that, as declaired in Table (2) and Fig. (13), the M. biceps femoris is the heaviest among the muscles of propulsion in rabbit and cat and the M. vastus intermedius is the lightest in rabbit and cat followed by the muscle superficial gluteal and vastus medialis. EL-SHARABY (1990) mentioned that, the biceps femoris of the gluteobiceps muscle is the heaviest one in rabbit, dog, cattle, donkey and camel.

REFERENCES

Bradley, O. and C.T. Grahame (1946): The topographical anatomy of the limbs of the horse, 2nd Ed. W. Green and son limited Edinburgh.

El-Sharaby, A.A.M. (1990): Surgical anatomical studies on the muscles forming the calcaneal tendon in some domestic animals. Thesis M.V.Sc., Fac. Vet. Med., Alex. Univ.

Getty, R. (1975): Ruminant myology in SISSON and GROSSMAN'S; the Anatomy of the Domestic animals. 5th Ed. Vol. 1 W.B. Saunders company.

Harrison, B.M. (1962): Disection of the cat & comparison with man (A laboratory manual on felis domestica) 4th Ed. The C.V. Mosby company, saint lois.

May, N.D.S. (1970): Anatomy of sheep, a dissection manual 3rd Ed. Univ. of Queensland press. St. Lucia Queensland.

McClure, C.R.; M.J. Dellman and Garrett (1973): Cat anatomy, an atlas, text and dissection guide 1st Ed. Lea and Febiger, Philadelphia.

McCleod, W.M. (1960): Bovine anatomy 2nd Ed. Surgess publishing company.

Miller, M.E.; G.C. Christensen and H.E. Evans (1964): Anatomy of the dog 1st Ed. W.B. Saunders comp. Philadelphia, London, Tronto.

Nickel, R.; Schummer, A.; Wille, K.H. and Wilkens, H. (1986): Passive locomotor system, muscular system in the anatomy of Domestic Animals. Eng. Ed. Vol. (1) Verlag paul parey, Berlin, Hamburg.

Nomina Anatomica Veterinaria (1983): Publ. by Int. Comitte on Vet. Gross. Anatomical Nomenclature under the finantial responsibility of the world association of Vet. Anatomists. 3rd Ed. Ithaca, New York.

Raghavan, D. and P. Kachroo (1964): The anatomy of ox. 1st Ed. Indian council of agricultural research. New delhi.

Saber, A.S. and A.K. Ahmed (1987): Morphological study on the lateral and cranial muscles of the hip and thigh of the dromedary and their role in locomotion. Assiut Vet. Med. J. Vol. 19, No. 37, 8-15.

Sisson, S. (1975): Equine myology in SISSON and GROSSMAN'S "The Anatomy of Domestic Animals" Revised by R. Getly 5th ed. Vol. 1 W.B. Saunders company.

Smuts, S.M.M. and J.A. Bezuidenhout (1987): The anatomy of Dromedary, 1st Ed. claredon press, oxford.

LEGENDS

Fig. 1 & 2: Showing the muscles of propulsion on the lateral aspect of the hip and thigh in rabbit (1) and cat (2).

1- M. tensor fasciae latae.
2- M. gluteus superficialis.
3- M. gluteus medius.
4- M. gluteus profundus.
5- M. Biceps femoris.
5'- Vertebral head of 5.
5"- Ischiatic head of 5.
6- M. Semitendinosus.
7- M. semimembranous.
8- M. sartorius.

Fig. 3 & 4: Left pelvic bone of rabbit (3) and cat (4) illustrating the muscles attachment (lateral view).

1- M. tensor fasciae latae.
2- M. gluteus superficialis.
3- M. gluteus medius.
4- M. gluteus profundus.
5- M. biceps femoris (ischiatic head in rabbit).
6- M. semitendinosus.
7- M. Rectus femoris.
8- M. sartorius.

Fig. 5 & 6: Showing the muscles of propulsion on the cranial aspect of the thigh in rabbit (5) and cat (6) craniolateral view).

1- M. vastus lateralis.
2- M. vastus intermedius.
3- M. rectus femoris.
4- Straight tendon.

Fig. 7 & 8: Left femur of rabbit (7) and cat (8) illustrating the muscles attachment (lateral view).

Fig. 9 & 10: Left femur of rabbit (9) and cat (10) illustrating the muscles attachment (medial view).

Fig. 11: Left femur of the rabbit illustrating the muscles attachment (caudal view).

1- M. gluteus medius.
2- M. gluteus profundus.
3- M. vastus lateralis.
4- M. gluteus superficialis.
5- M. vastus intermedius.
6- M. vastus medialis.

Fig.(1)

MUSCLES OF PROPULSION IN RABBIT AND CAT

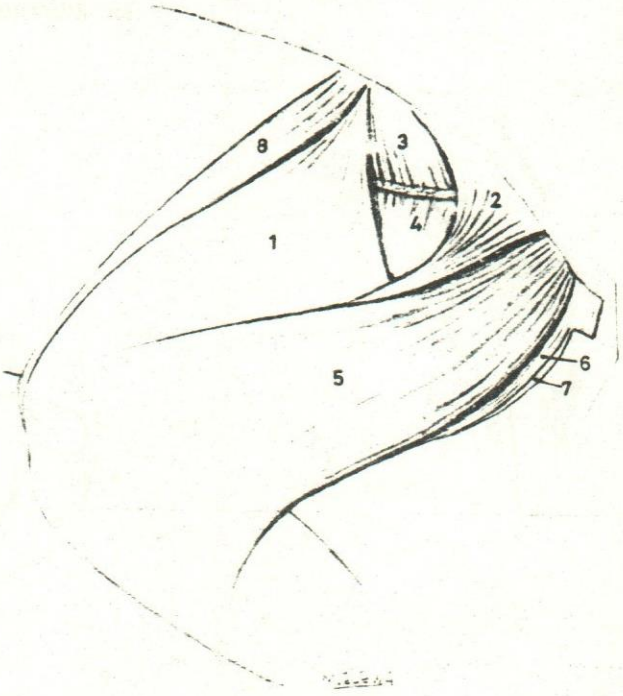

Fig.(2)

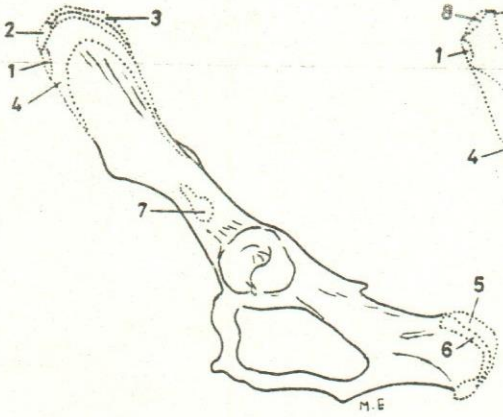

Fig.(3)

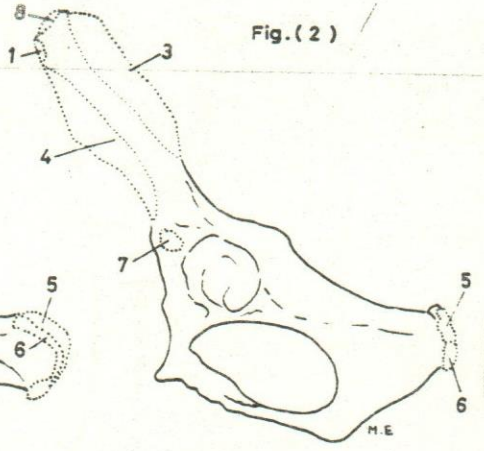

Fig.(4)

Fig.(5)

Fig.(6)

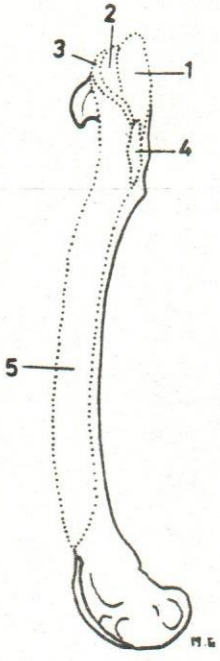

Fig.(7)

MUSCLES OF PROPULSION IN RABBIT AND CAT

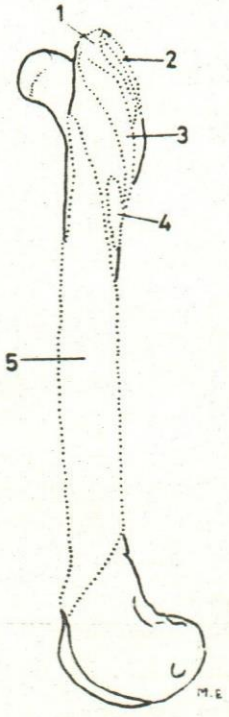

Fig.(8)

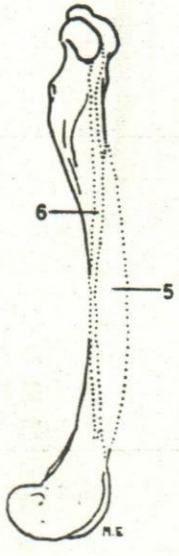

Fig.(9)

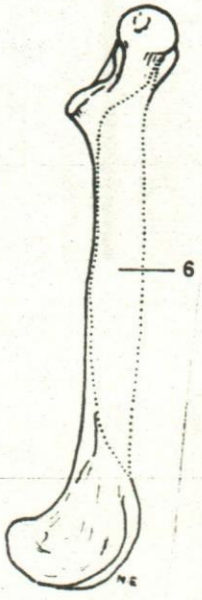

Fig.(10)

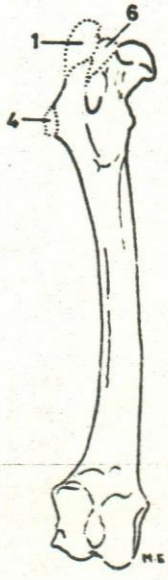

Fig.(11)

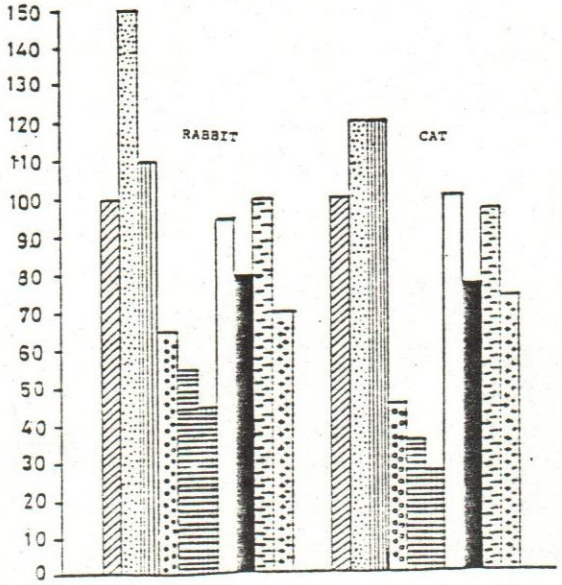

Fig. (12): Relative length of the muscles of propulsion to the length of the femur in rabbit and cat.

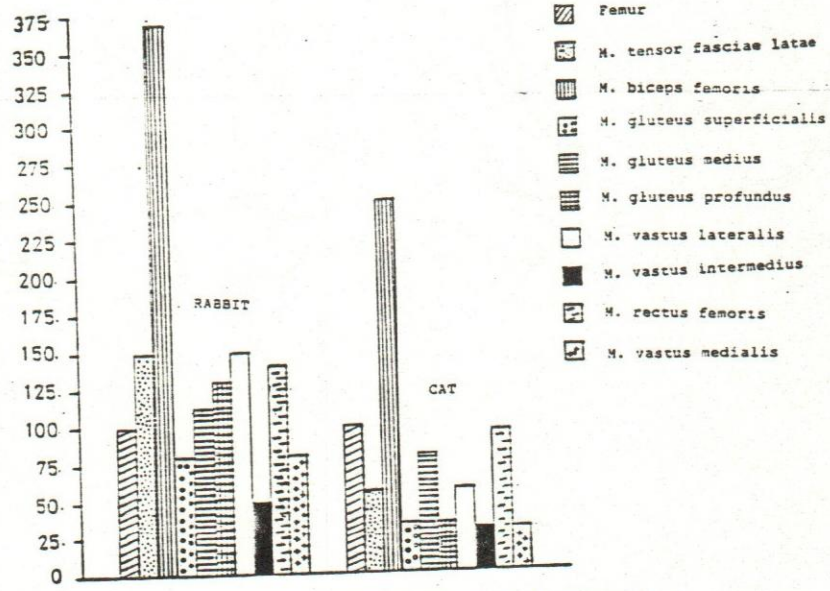

Fig. (13): Relative weight of the muscles of propulsion to the weight of the femur in rabbit and cat.

Table (1):Relation of the length of the muscles of propulsion to the length of the femur in rabbit and cat.

Animal	Absolute length (cm)										Ralative length (%)								
	Femur	m.T. F.L.	M. Bicep. Fem.	M. gl. sup.	M. gl. med.	M. gl. Prof.	m.V. L.	M.V. int.	m.R. F.	M.V. m.	m.T. F.L.	M. Bicep. fem.	M.gl. sup.	M.gl. med.	M.gl. prof.	M.V. L.	M.V. Int.	m.R. F.	m.V.M.
Rabbit	10 cm	15	11	6	5	4	9.5	8	10	7	150%	110%	60%	50%	40%	95%	80%	100%	
Cat	10 cm	13	13	5	4	3	10	8.5	10	8	118%	118%	45%	36%	27%	99.9%	77%	96%	73%

Table (2):Relation of the weight of the muscles of propulsion to the weight of the femur in rabbit and cat.

Animal	Absolute weight (gm)										Ralative weight (%)								
	Femur	M.T. F.L.	M. Bicep. Fem.	M. gl. sup.	M. gl. med.	M. gl. prof.	M.V. L.	M.V. int.	M.R. F.	M. V.M.	m.f.F.L	M. Bicep. fem.	M.gl. sup.	M.gl. med.	M.gl. prof.	M.V.L.	M.V. Int.	M.M. F.	M.V.M.
Rabbit	10	15	37	8	11	13	15	5	14	8	150%	370%	80%	110%	130%	150%	50%	140%	80%
Cat.	14	8	35	5	11	5	20	4	13	4	57.2%	250%	35.7%	78.5%	35.7%	57.1%	28.5%	92.8%	28.5%