

**ADDUCTOR MUSCLES OF THE FEMUR ANATOMICAL VARIATIONS -
LITERATURE REVIEW**

**MÚSCULOS ADUTORES DO FÊMUR VARIAÇÕES ANATOMICAS - REVISÃO
BIBLIOGRÁFICA**

**MÚSCULOS ADUCTORES DEL FÉMUR: VARIACIONES ANATÓMICAS -
REVISIÓN BIBLIOGRÁFICA**

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ABSTRACT

The literature review for this study demonstrated that the femoral adductor muscle group is composed of a complex architecture that remains difficult to understand in its entirety. We conclude that the femoral adductor muscles can present anatomical variations in their shape, size, insertions, and even the functions they perform. This is of paramount importance from a clinical perspective, since, during surgeries in the medial thigh region, their entire composition and possible variations must be taken into account to avoid risks related to the innervation and vascularization of the lower limbs. Understanding regional anatomy is essential to avoid impacting the biomechanical balance of the hip and thigh in both clinical and surgical contexts.

Keywords: Adductor Muscles of the Femur. Anatomy.

RESUMO

A revisão bibliográfica do presente estudo demonstrou que o grupo dos músculos dos adutores do fêmur é composto de uma arquitetura complexa e ainda difícil compreensão na sua totalidade. Concluímos que os músculos adutores do fêmur podem apresentar variações anatômicas em suas formas, tamanhos, inserções e até mesmo nas funções realizadas. Isso é de suma importância, uma vez que, durante cirurgias na região medial da coxa, sua integral composição e possíveis variações devem ser levadas em consideração, evitando riscos relacionados à inervação e vascularização dos membros inferiores. O entendimento da anatomia regional é fundamental para não impactar no equilíbrio biomecânico do quadril e coxa tanto em contextos clínicos como cirúrgicos.

Palavras-chave: Músculos Adutores do Fêmur. Anatomia.

RESUMEN

La revisión bibliográfica de este estudio demostró que los músculos aductores del fémur poseen una arquitectura compleja y aún resultan difíciles de comprender en su totalidad.

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Concluimos que estos músculos pueden presentar variaciones anatómicas en su forma, tamaño, inserción e incluso en sus funciones. Esto reviste suma importancia, ya que, durante las cirugías en la región medial del muslo, se debe considerar su composición completa y posibles variaciones para evitar riesgos relacionados con la innervación y vascularización de las extremidades inferiores. Comprender la anatomía regional es fundamental para no afectar el equilibrio biomecánico de la cadera y el muslo, tanto en el contexto clínico como quirúrgico.

Palabras clave: Músculos Aductores del Fémur. Anatomía.

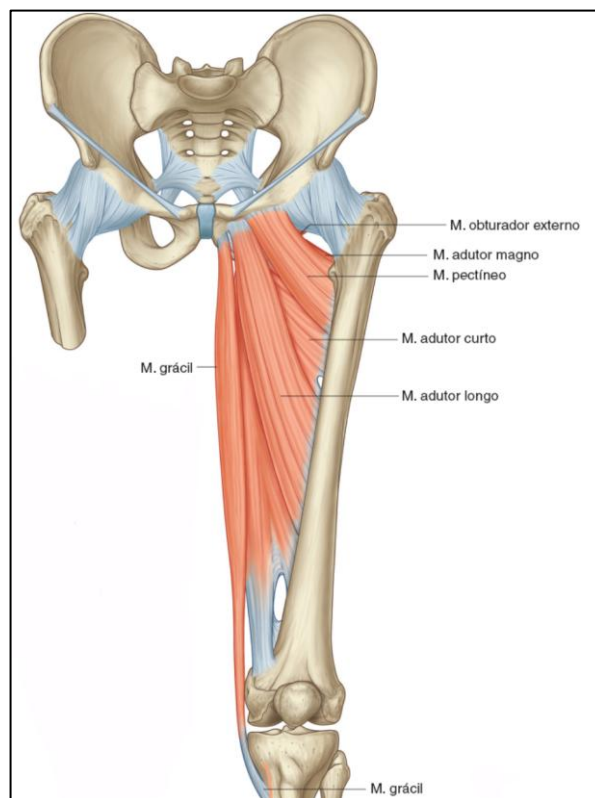
1 INTRODUCTION

According to Moore, the femoral adductor muscle group is formed by the muscles of the medial compartment of the thigh, including the adductor brevis, adductor longus muscle, adductor magnus muscle, gracilis muscle, and obturator externalus muscle. ¹

However, other authors, such as Van de Graaff, consider that the femoral adductor group has, in its composition, the pectineus, gracilis, adductor longus, adductor brevis and adductor magnus muscles.² (Fig. 1)

Figure 1

Femoral adductor region



Source: Adapted by the authors from: GRAY, 2021. ²

We will verify, through a literature review, the specific composition of the femoral adductors, analyzing the number of structures in this region.

In this context, the objectives of this work were:

- Collection of classic and contemporary literature on the subject.
- Identification of how many and which components make up this anatomical set/region.

2 METHODOLOGY

The methodology of choice for the following research was a bibliographic review with an exploratory approach.

For Marconi and Lakatos (2019), bibliographic reviews are intended to put the researcher in direct contact with everything that has been written, said or filmed on the subject.

Not being a mere repetition of the subject, but providing analysis of the theme from another perspective or approach, to reach new conclusions.³

The research followed the recommended methods, after choosing the theme and preliminary research. The researched samples were read, selected, evaluated and analyzed.

The characteristics of the research were defined in order to discuss, interpret and present the results achieved.

The guiding question was: Are there variations in its composition?

For a bibliographic review of the theme, searches were carried out in printed bibliographies and digitized articles. The Anatomical Laboratory of the University of Contestado (UNC) was also used to complement and analyze its structures in loco.

The articles were collected until August 2025, preferably up to 5 years old, surveying works specifically related to the proposed theme and resulted in 7 articles.

In the researched articles, a pattern was noticed in the problem addressed, that is, the authors also had the same doubt as in the present study with the object of the research.

Understanding this subject is of great importance for physicians and professionals who work in both the field of orthopedics and radiology.

3 HISTORY

3.1 ANATOMICAL NAME

According to Tatsuo Sakai in his revisional article "Historical evolution of anatomical terminology from a cient to modern" the history of *the anatomical nomina* can be divided into five stages.⁵

The first is represented by the oldest extant anatomical treatises by Galen of Pergamon in the Roman Empire, where he used a limited number of anatomical terms that were essentially colloquial words in the Greek of that period.⁶

The second stage, Andreas Vesalius in the early sixteenth century described anatomical structures in his book *De Humani Corporis Fabrica Libri Septem*⁶, known as the

first modern book on anatomy⁷, which presented magnificent details and illustrations, even though he did not coin substantially any anatomical terms, he developed a system that distinguished anatomy structures with ordinal numbers⁶, Andreas Vesalius was considered, while still alive, as the creator of modern anatomy.⁷

The third stage at the end of the sixteenth century, he calls being marked by a great innovation in the development of specific anatomical terms, especially muscles, vessels and nerves. Thus marking a great advance in the anatomical nomina. The main figures were Jacobus Sylvius in Paris and Gaspard Bauhin in Basel, Switzerland.^{6,7}

Between Bauhin and international anatomical terminology, many anatomy textbooks were written mainly in Latin in the seventeenth century, and in modern languages in the eighteenth and nineteenth centuries.⁶ Thus, anatomical terms of the same structure have been expressed with different names by different authors.

Faced with the diverse terminology in numerous anatomical forms and books, anatomists came together to try to create terms that were logically consistent, intelligible in themselves, clear in meaning and compact in form.^{5,6}

It took six years to arrive at the establishment of guidelines and it was at the ninth conference of the Anatomische Gesellschaft held in Basel, Switzerland that the international anatomical terminology in Latin was published as Anatomical Basel Nomina.⁶ It is important to note that each country could have the freedom to translate the official Latin terms into its own language for teaching purposes.⁸ The anatomical Basel Nomina was not a new terminology, but rather a careful selection of existing names,⁸ the product of an international group of anatomists working together.^{5,6}

As science progressed, the terminology was revised several times until the current Anatomical Terminology, both in Latin and English.^{5,6} The first English edition of the Eycleshymer, published in 1917, records the results of the work at the Basel Conference. In the preface, he states that they searched from 50,000 names for 5,000 structures,⁶ reducing them to 5,000. They did so, and currently, the convention has had several subsequent editions that counts 7,000 terms.⁵

4 RESULTS AND DISCUSSION

The muscle group of the femoral adductors is composed of:

Pectineus muscle, Adductor brevis muscle, Adductor longus muscle, Adductor magnus muscle, Gracilis muscle, Obturator external muscle.^{1,2}

For a better understanding, we will individually detail the component elements of the external rotators of the hip in the studies surveyed:

4.1 PETTINEOUS MUSCLE

The pectineus muscle has a square and flat shape. It originates in the superior ramus of the pubis and inserts distally on the pectineal line of the femur, immediately inferior to the lesser trochanter. It is a muscle vascularized by the anterior branch of the obturator artery and by branches of the medial femoral circumflex artery,^{1,3} and innervated by the femoral artery (L2, L3); it can receive a branch of the obturator N.¹

Its main action is to slightly adduct and flex the hip joint; it aids in lateral rotation.¹

As cited by Kim and Nam in their paper, bilateral variations were identified in the pectineal muscles of an 82-year-old male cadaver. The superficial and deep layers were divided into their distal portion, forming a triangular-shaped hiatus between them and the femoral shaft. Distally, the superficial tendon of the pectineus joined the adductor longus, while the deep tendon inserted into the pectineal line.

It was observed that the deep femoral artery and its first perforating artery were passing through the hiatus – not previously reported – with variations between the right and left sides. These alterations represent an ontogenetic vestige of the two origins of the pectineum.⁹

4.2 ADDUCTOR BREVIS MUSCLE

The adductor brevis muscle has a triangular shape. It originates in the body and inferior ramus of the pubis and inserts distally on the pectineal line and proximal part of the coarse line of the femur. It is a muscle supplied by the anterior branch of the obturator artery and innervated by the N. obturatorium, branch of the anterior division (L2, L3, L4).¹

Its main action is to adduce the hip joint and partially flex it.¹

In the last five years, no articles were found that dealt with its anatomical variations, however, a 2012 article written by Davis et al. showed that the adductor brevis muscle can be divided into two muscle bellies, present partial fusion with neighboring muscles (such as the adductor longus, pectineus, or adductor magnus) and even originate from different areas of the pubis.

A frequent finding in dissection studies is the fusion of the proximal tendon of the adductor brevis with that of the gracilis, forming a common insertion in the pubis. In addition,

the adductor brevis has a relatively long intramuscular tendon, whose vascularization decreases as it approaches the bone insertion, leaving the enthesis region less irrigated and more susceptible to injury or degeneration. In some cases, it has also been observed that the muscle receives double innervation (through the anterior and posterior branches of the obturator nerve).¹⁰

4.3 ADDUCTOR LONGUS

The adductor longus muscle has a fan shape. It originates from the body of the pubis inferior to the pubic crest and inserts distally into the middle third of the coarse line of the femur. It is a muscle vascularized by the anterior branch of the obturator artery and by medial branches of the femoral circumflex artery,^{1,3} and innervated by the N. obturator, branch of the anterior division (L2, L3, L4).¹

Its main action is the adduction of the hip joint.¹

According to Patrícios, the adductor longus muscle originates from the superior pubic ramus and the pubic symphysis, diverging from the classical literature, which has its origin in the inferior pubic ramus.¹¹

4.4 ADDUCTOR MAGNUM MUSCLE

The adductor magnus muscle has a triangular shape, being a muscle composed of two parts that differ in insertions, innervations, and functionalities.¹

Its adductor part originates from the inferior ramus pubis, the ramus of the ischium and inserts on the gluteal tuberosity, rough line, medial supracondylar line, while the part associated with the hamstring muscles originates from the ischial tuber and inserts on the adductor tubercle of the femur.¹

It is a muscle vascularized, in its entirety, by the perforating arteries - originating from the deep femoral artery - and by the anterior branch of the obturator artery, and innervated, in the adductor part, by the obturator N. (L2, L3, L4), branches of the anterior division and, in the part connected to the hamstring muscles, by the tibial part of the sciatic N. (L4).¹

The differentiation of its parts extends to function, the adductor part is responsible for flexing the hip joint, while the part associated with the hamstring muscles stretches the hip joint.¹

In their article detailing the adductor magnus muscle, Jeno et al. pointed to two studies that dealt with variants in the structure of this muscle. In the first study, carried out by Tubbs

et al. and based on cadaver dissections, differences were presented regarding the adductor minimus muscle - which is part of the adductor magnus muscle - most of the cadavers had the adductor minimus distinct from the adductor magnus.

Others exhibited the partially fused adductor minimus, and finally, the study reported that this muscle part may be absent or underdeveloped.¹²

The second study, published by Takizawa et al., exposed the proximal portion of the adductor magnus muscle as having a different fiber morphology from the others. The difference in muscle fibers also reflects on their function, the portion discussed was observed as adequate to stabilize the lower limb, while more distal portions were more efficient to increase the range of motion of the thigh.¹²

4.5 GRACILE MUSCLE

The gracilis muscle has a belt shape. It originates from the body and lower ramus of the pubis and inserts distally on the upper part of the medial aspect of the tibia (as part of the goosefoot). It is a muscle vascularized by the anterior branch of the obturator artery and by branches of the medial femoral circumflex artery, and innervated by the obturator nerve (L2, L3).¹

Its main action is adduction of the hip joint and flexing the knee joint by rotating it medially.¹

According to Khan et al., the volume of the gracilis muscle is smaller in women when compared to men.¹³

San Martin found, in his study, that there are differences in the mean width of the gracilis muscle when comparing studies with the Argentine (79.82 ± 67.15) and Brazilian (86.44 ± 4.09 cm) populations. He also found disagreements regarding muscle length, with authors describing an average of 30 cm, while Martin found an average of 42.25 cm. Finally, the researcher emphatically disagrees with the absence of an intramuscular tendon, the author points out that the muscle is delimited by two tendons, with an insertion tendon with an intra- and extramuscular portion.¹⁴

4.6 OBTURATOR EXTERNAL MUSCLE

The obturator externus muscle is fan-shaped, and is a flat and relatively small muscle. It originates on the outer surface of the obturator membrane, at the margins of the obturated foramen, and inserts distally on the posterior aspect of the greater trochanter. It is

a muscle vascularized by the anterior branch of the obturator artery and innervated by the obturator artery (L3, L4).¹

Its main action is lateral rotation and stabilization of the hip joint.¹

Juan José et al. described an anatomical variant associated with obturator nerve compression when there is the presence of a supernumerary external obturator muscle, which traps the nerve at the exit of the pelvic region.¹⁵

As a didactic summary of the bibliographic research, we have the following exposition (Table 1):

Table 1

Comparison of Classical Anatomy with current Bibliographic Survey

Femoral adductors	Classical anatomy	Bibliographic survey
Pectineus	Unique	Hiatus presentation
Adductor brevis	Unique	Division into two wombs; Partial fusion with muscles
Adductor longus	Unique	Origin in the superior pubic ramus and pubic symphysis
Adductor magnum	Unique	Adductor minimus junction; Morphology of fibers different in the proximal and distal portion
Gracilis	Unique	Presence of intramuscular tendon delimiting the muscle
External shutter	Unique	Presence of a supernumerary muscle

Source: Authors.

5 CONCLUSION

The literature review of the present study demonstrated that the femoral adductor muscle group is composed of a complex architecture that is still difficult to understand in its entirety.

Through the analysis of articles surveyed, we concluded that the adductor muscles of the femur may present anatomical variations in their shapes, sizes, insertions, and even in the functions performed.

This is of paramount importance in the clinical view, since during surgeries in the medial region of the thigh, its integral composition and possible variations must be taken into account, avoiding risks related to the innervation and vascularization of the lower limbs.

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