

Morphological and morphometric analysis of Psoas Minor Muscle in cadavers

Farias, MCG.¹, Oliveira, BDR.², Rocha, TDS.³ and Caiaffo, V.^{4*}

¹Departamento de Biologia, Universidade Federal Rural de Pernambuco – UFRPE,
Rua Dom Manoel de Medeiros, s/n, Dois Irmãos, CEP 52171-900, Recife, PE, Brasil

²Departamento de Fisioterapia, Associação Caruaruense de Ensino Superior – ASCES,
Av. Portugal, 584, Mauricio de Nassau, CEP 55016-400, Caruaru, PE, Brasil

³Departamento de Fisioterapia, Universidade Federal Rural de Pernambuco – UFRPE,
Av. Professor Moraes Rego, 1235, Cidade Universitária, CEP 50670-901, Recife, PE, Brasil

⁴Departamento de Morfologia e Fisiologia Animal, Universidade Federal Rural de Pernambuco – UFRPE,
Rua Dom Manoel de Medeiros, s/n, Dois Irmãos, CEP 52171-900, Recife, PE, Brasil

*E-mail: vcaiaffo@gmail.com

Abstract

The Psoas Minor Muscle is considered inconstant and it's often absent. This muscle consists of a short proximal fixation tendon originated from the sides of the twelfth thoracic vertebra, first lumbar vertebra and corresponding intervertebral disc, continuous with a short spindle-shaped morphology muscular venter, ending with a long distal fixation tendon inserted in the pectineal line of the pubis and iliopectineal eminence. Due to the lack of information in literature regarding Psoas Minor muscle's morphology and morphometry, this study aimed to obtain more detailed information about the muscle in order to expand knowledge of its morphology and morphometry. In order to perform this study, it was used as work material 30 cadaver parts of lower limbs belonging to the anatomical specimens' collection of Federal Rural University of Pernambuco and Federal University of Pernambuco. It was found in this study, an absence percentage of Psoas Minor Muscle around 73%. The muscles analyzed did not show any anatomical variation and presented as morphometric characteristics a proximal tendon with average length of 18.11 mm, a muscular venter with average of 71.25 mm for your length and a length for a distal tendon with average of 150.97 mm. This study confirms the literature's descriptions, demonstrating the inconstancy of Psoas Minor Muscle and, in our results, it did not show any morphological changes related to its proximal or distal fixation, and to its muscular venter. However, our results showed unpublished data related to width and thickness of the muscle venter of the Psoas Minor.

Keywords: Psoas Minor Muscle, morphology, morphometry.

1 Introduction

The Psoas Minor Muscle (PMM) is located in the abdomen in front of the Psoas Major Muscle. In general it originates from the sides of the twelfth thoracic vertebra (T12), first lumbar vertebra (L1) and the corresponding intervertebral disc. The short muscular venter is continuous with a thin tendon which is inserted into the pectineal of the pubis, in the iliopectineal eminence and laterally in the iliac fascia (O'RAHILLY, 1986; WILLIAMS and WARWICK, 1992).

The Psoas Minor Muscle performs the bending of the pelvis and lumbar spine and tilt it sideways (GRAY, 1977) as well as providing stabilization of the hip joint (MOORE and DALLEY, 2007). It is classified as inconstant muscle (TELLEZ and ACUÑA, 1998) and it is often absent (GRAY, 1977). It is the muscle that has the highest percentage of unilateral or bilateral agenesis, considered between 40% and 66% of the population (MACALISTER, 1875, apud TELLEZ and ACUÑA, 1998; MORI, 1964; WILLIAMS and WARWICK, 1992). When it occurs, this region can be occupied by a thin tendon and, most commonly, by an

expansion of the medial border of the Psoas Major Muscle (MACALISTER, 1875 apud TELLEZ and ACUÑA, 1998).

Morphological and morphometric descriptions on the Psoas Minor Muscle are scarce in the literature; in most cases it is only mentioned. Thus, this study aimed to determine the prevalence of Psoas Minor Muscle and describe its morphology and morphometry in order to identify the features of its muscular venter, proximal and distal tendons, facilitating the understanding of its real contribution to human biomechanics.

2 Material and methods

This study was developed at the Department of Animal Morphology and Physiology (DMFA) of Federal Rural University of Pernambuco (UFRPE) and the Department of Anatomy of Federal University of Pernambuco (UFPE). All cadaver parts analyzed during the study were obtained from the anatomical specimens' collection of the aforementioned institutions. Analyses were carried out from August to November 2011.

Thirty cadaver parts were analyzed where the following variables were evaluated: presence of muscle; muscle length; muscular venter length; length of insertion and origin tendon; width and thickness of muscular venter; presence of some morphological variation of the muscle; presence of any anatomical changes in the proximal fixation tendon (origin) of the muscle and finally the presence of any anatomical variations in the distal fixation tendon (insertion) of the muscle.

The data concerning the presence of Psoas Minor Muscle, and presence of anatomical variation (morphology, proximal or distal fixation tendons) were collected through visual inspection and photographic record while values referring to total length and length of the muscle's insertion tendon were obtained on a scale of centimeters (cm) by using a tape measure 150 cm, and subsequently converted to a scale in millimeters (mm). Values regarding other variables were measured with a Digital Pachymeter 0-150 mm (Jomarca STAINLESS HARDENED) accuracy of 0.01 mm and a pen to mark the points defined as a reference for measurements.

For each variable analyzed, three measurements were performed, considering as real measurement the arithmetic average of values found, obtained through Microsoft Excel Starter Software 2010.

With the aid of a tape measure, it was firstly measured the total length of the muscle from its proximal fixation to its distal fixation (Figure 1) and then the insertion tendon length, considering, as a starting point of the measurement, the point where a great number of muscle fibers ends until its distal fixation.

Then, with the aid of a digital pachymeter, the following variables were measured: length of the muscular venter (Figure 2), length of the origin tendon, width and thickness of the muscular venter. Concerning the measurement of the muscular venter length, it was considered as beginning and end of it the point where it begins and ends, respectively, the greatest number of muscle fibers; these points are marked with a pen. For the variable length of the origin tendon, it was considered as reference the point where the greatest number of muscle fibers begins to its proximal fixation; with regard to width and thickness of the muscular venter, the measurement was performed at the midpoint of the muscular venter. All data were organized into a table drawn up for the gathering and analyzed later on.



Figure 1. Measuring the total length of the muscle by using a tape measure

3 Results

The Psoas Minor Muscle was absent in 73.33% of the cadaver parts analyzed and showed a presence rate of 26.66%, being present in 08 (eight) parts. However, from this percentage of PMM presence, 50% of the parts showed unfeasible muscles for the study since during the process of dissection they were somehow damaged thus making its analysis impossible, whereas the remaining 50% showed muscles in good conditions, enabling the measurement of variables set in this study's objectives (Figure 3).

This study did not show any anatomical variations related to proximal or distal fixation of muscles analyzed. All muscles showed a short continuous proximal fixation tendon with a short muscular abdomen, spindle morphology, continuous with a long distal fixation tendon, arranged posterior and anteriorly the Psoas Major Muscle.

The Table 1 shows the average values of following variables: total length of PMM, muscle venter length, length of the origin tendon (proximal) and the length of insertion tendon (distal). Furthermore, the width and thickness of the muscle venter.

4 Discussion

This study did not establish, by visual inspection, any anatomical variations in terms of both muscular venter morphology or proximal and distal fixation of the muscle. However and Bergman, Thompson, Afifi et al. (1988) stated that anatomical variations and anomalies have been described in Psoas Muscles. Tellez and Acuña (1998) reported that many variations in its body shape, its origins and insertions were also described, which have been associated with gender, race and population.



Figure 2. Measuring the muscular abdomen by using a digital pachymeter 0-150mm (Jomarca STAINLESS HARDENED).

Table 1. Values regarding the average (mm) and standard deviation of measured variables.

Variables	Value
Total length	239.89 ± 30.07
Length of muscular abdomen	71.25 ± 17.79
Length of insertion tendon	150.97 ± 7.96
Length of origin tendon	18.11 ± 11.06
Width of muscular abdomen	17.11 ± 5.14
Thickness of muscular abdomen	4.67 ± 1.58

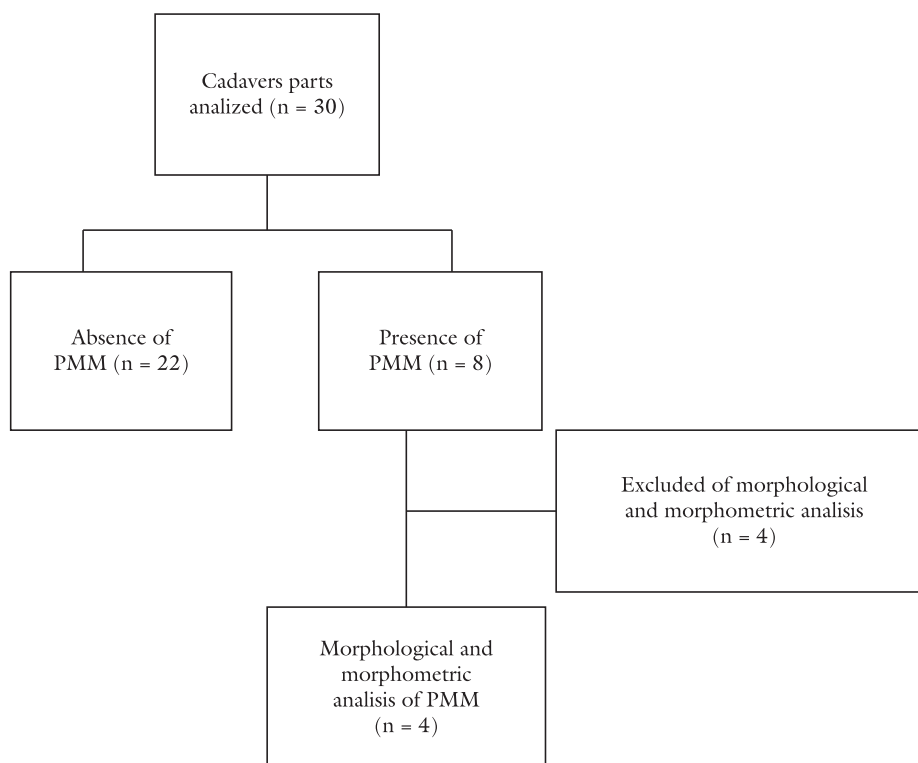


Figure 3. Flowchart of the cadavers parts analysis used in the study.

Bergman and Afifi (1997) showed variations of insertions on the inguinal ligament, femoral neck and lesser trochanter of the femur together with the Psoas Major Muscle. Macalister (1875 apud TELLEZ and ACUÑA, 1998) and Ledouble (1897 apud TELLEZ and ACUÑA, 1998) stated that, with respect to the origin, the tendon may be split and send an extension to the fifth lumbar vertebra and first sacral vertebra, and another one to iliopectineal line; in addition, its insertion may also be continuous with the pelvic fascia or directly with the iliac fascia.

With respect to presence/absence variable of the Psoas Minor Muscle, it was found information uniformity in the literature, which confirms the results of this work. Previous studies have already showed a high percentage of Psoas Minor Muscle absence. Rickenbacker, Landholt and Theiler (1985) stated that this rate of absence could reach 50% of individuals. Anson (1966) reported the bilateral lack of Psoas Minor Muscle in 41% of individuals analyzed while for Williams (1995) this ratio could be over 50%. Macalister (1875 apud TELLEZ and ACUÑA, 1998), Mori (1964), Williams and Warwick (1992 apud TELLEZ and ACUÑA, 1998) stated that the Psoas Minor Muscle has the highest percentage of unilateral or bilateral agenesis, considered between 40% and 66% among the population, confirming the quotation made by Macalister (1875 apud TELLEZ and ACUÑA, 1998) which reports that the muscle under study is considered the most inconstant in the human body. Hanson, Magnusson, Sorensen et al. (1998) – in their studies – taking into account the race of analyzed cadavers, showed a percentage of 91% of PMM absence in black individuals while this percentage decreased to only 13% in white individuals. It demonstrates that the presence/absence variable may be closely related to race. These data are consistent with the findings of Bergman

and Afifi (1997), which reported an agenesis percentage of 57% in 4,507 white individuals and 66.6% in 674 cadavers of black people. To a certain extent, the above information confirms the data obtained from this study since it was found a high percentage of the muscle absence, reaching approximately 73%. However, it is worth noting that in our study it was not considered the race of the body examined, because the institutions did not have any documentation regarding cadavers data; even so, a high rate of absence was confirmed.

Gray (1977) mentioned that the PMM is a long muscle, but it is thin and has a long distal fixation tendon and a short proximal tendon. However, he did not report any values for its morphology. This study corroborates Gray (1997), determining, however, these muscle's morphometric values (Table 1), hitherto unpublished in literature like length of tendons, width and thickness of muscle venter.

5 Conclusion

The Psoas Minor Muscle is really an inconstant muscle due to the percentage of absence in parts analyzed. Concerning the morphometry, our study is the first one to report the total length variables of the muscle, length of proximal and distal fixation tendon as well as the width and thickness of the muscular abdomen.

Therefore, this study provides important information for further studies, suggesting the analysis of a greater number of cadavers parts, as well as carrying out in vivo morphological and morphometric studies with the aid of imaging tests.

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