

**Original Research Article****Biometrics of Psoas Minor Muscle in North Indian Population**

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**Abstract**

Psoas minor is classified as an inconstant muscle which is frequently absent. It is a muscle of posterior abdominal wall, lying anterior to the psoas major. The psoas minor is a weak flexor of the lumbar vertebral column and is innervated by the anterior ramus of nerve L1. Previous literatures lack proper description about the morphology and function of this muscle. Psoas minor muscle has been associated with a painful condition of abdomen, the psoas minor syndrome. We conducted a study on 20 formalin fixed cadavers in relation to prevalence, morphology, variations and morphometry of psoas minor muscle. It was found, that the percentage of absence of psoas minor muscle was 65%. No anatomical variation of the muscle was seen. Morphometric analysis demonstrated the average total length of muscle to be 215.2 mm, average length of muscle belly 67.7 mm, average tendon length 145.7 mm, while average width and thickness of muscle were 13.6 mm and 3.4 mm, respectively. This study provides valuable information on psoas minor muscle which may help in proper understanding of anatomy, function and clinical importance of the muscle.

**Keywords:** Morphometry, psoas muscle, morphology, variation, trisomy 18**Correspondence:**

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**Introduction**

The psoas minor is a small muscle with a long flat tendon, frequently absent but when present it lies anterior to psoas major in posterior abdominal wall. It arises from the sides of the bodies of the 12th thoracic and first lumbar vertebrae and from the disc between them and is inserted on the pectineal line and ilipectineal eminence and laterally in the iliac fascia (1,2).

It is classified as an inconstant muscle. The frequency of its absence in human beings is between 40% to 66% of the population. When it is absent, this region is occupied by a thin tendon as an expansion of the medial border of the psoas major muscle (3).

The function of psoas minor is understated but it helps in flexion of spine and along with psoas major it helps in flexion of the hip (4). It is functionally

important in leaping animals but less important in humans (5).

The psoas minor and its tendon may fail to keep pace with the growth of pelvis and this can cause tense psoas minor muscle and tendon leading to psoas minor syndrome. This syndrome on right side has been wrongly diagnosed as appendicitis. An important cause of symptoms from a muscle may be due to disproportionate growth. Tenotomy of psoas minor muscle relieves the symptoms of psoas minor syndrome (6).

Morphological and morphometric descriptions of the psoas minor muscle are infrequent in the literature; Thus, this study was aimed to determine the prevalence of psoas minor muscle in relation to sex and describe its morphology and morphometry, which may help in understanding of its real functional and clinical importance.

## Materials and Methods

The present study was conducted in the Department of Anatomy, Maulana Azad Medical College, New Delhi, India. Twenty embalmed cadavers in the age group of 35-50 years were included in the study. The cadavers with surgery marks or injury scar marks to abdominal wall were excluded from the study. Following dissection of the anterior abdominal wall, resection of abdominal organs, the posterior abdominal wall was dissected. After removal of kidneys, the psoas major and minor muscles were exposed. The following variables were studied: Presence of psoas minor muscle; total muscle length; length of muscle belly; length of tendon; width and thickness of muscle belly; presence of any morphological variation of the origin or insertion of the muscle. The width and thickness of the muscle was measured at the midpoint of the muscle. The measuring tape and manual vernier calipers were used for measurements. Photography was done using an CANON IXUS 95 IS digital camera. The data was collated and analyzed.

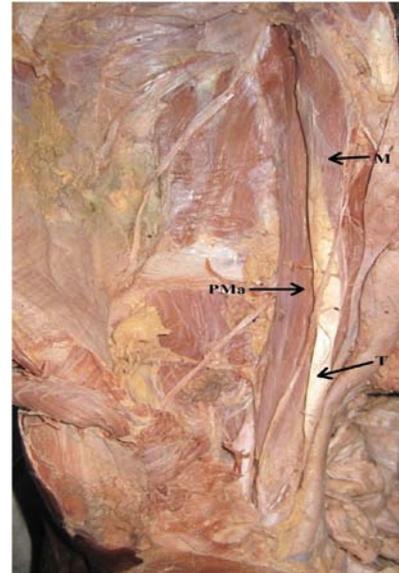
## Results

Out of 20 cadavers (16 males and 4 females) psoas minor muscle was present in 7 cadavers. The psoas minor was present unilaterally (Fig. 1) in one cadaver and bilaterally (Fig. 2) in 6 cadavers. The psoas minor muscle was present bilaterally in 6 male cadavers and unilaterally in one female cadaver. No anatomical variations related to origin or insertion of muscles was seen. The average value of total muscle length was  $215.2 \pm 11.09$  mm, length of muscle belly was  $67.7 \pm 3.42$  mm, length of tendon was  $145.7 \pm 3.5$  mm, width and thickness of muscle belly were  $13.6 \pm 1.09$  mm and  $3.4 \pm 0.39$  mm, respectively. Table 1 showed prevalence of psoas minor muscle while Table 2 showed the average values of total muscle length, length of muscle belly, length of tendon, width and thickness of muscle belly.

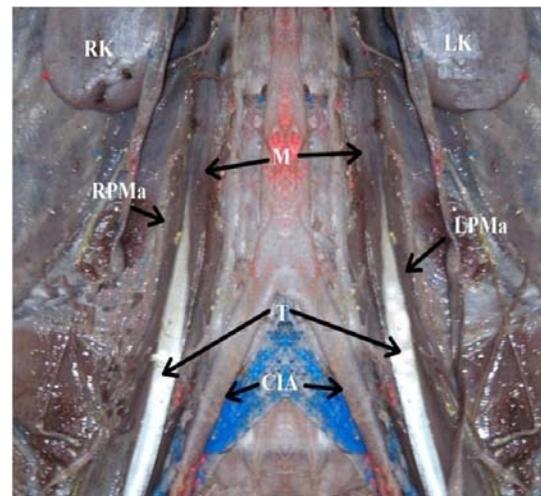
## Discussion

Vestigial muscles in human body are those muscles which are tendonous in greater part or reduced in size compared to homologous muscles in other species or are frequently absent within or between populations. The psoas minor muscle is known to exhibit such variations (7).

Absence of psoas minor is a consistent finding in patients with trisomy-18 syndrome (Edwards' Syndrome) (7). Higher frequency of muscle anomalies in aneuploidy is due to the delayed developmental processes in them. Muscles affected in them are



**Figure 1:** Unilateral psoas minor muscle on right side (T-Tendon of Psoas minor; M-muscle belly of Psoas minor. PMa- Psoas major muscle)



**Figure 2:** Bilateral psoas minor muscle (T-Tendon of Psoas minor; M-muscle belly of Psoas minor. RPMa-Right Psoas major muscle, LPMa-Left Psoas major muscle LK-Left kidney, RK-right kidney, CIA-common iliac arteries)

generally those that differentiate rather late during embryonic development (8).

Psoas minor has been found to be well developed in hopping animals like marsupials, macrocelides, Jerboa (9). It is well developed and constant in those animals who brachiate or run at very fast speed, where it is used to flex the pelvis on the trunk (10,11). It is active in cats when they arch their back (12). In humans, it has clinical significance in sports medicine, especially in athletes like professional golfers and mostly in

**Table 1:** Prevalence of psoas minor muscle

	<b>Total</b>	<b>Male</b>	<b>Female</b>
Bilaterally present	6 cases	6 cases (30 %)	0
Bilaterally absent	13 cases	10 cases (50 %)	3 cases (15 %)
Unilaterally present on right	1 case	0	1 case (5 %)
Unilaterally present on left	0	0	0
<b>Total</b>	<b>20 cases</b>	<b>16 cases</b>	<b>4 cases</b>

**Table 2:** Average morphometric values of psoas minor muscle

<b>Variables</b>	<b>Average value (mm) with standard deviation</b>
Total length of muscle	215.2 ± 11.09
Length of muscle belly	67.7 ± 3.42
Length of tendon	145.7 ± 3.5
Width of muscle	13.6 ± 1.09
Thickness of muscle	3.4 ± 0.39

**Table 3:** Percentage of absence of psoas minor muscle in different ethnic population

<b>Authors</b>	<b>Year</b>	<b>Population</b>	<b>Absence (%)</b>
Gruber et al.	1879	Russians	48%
Schwalbe et al.	1894	Alsations(France)	57%
Thomson et al.	Cited by Loth et al in 1931	English(England)	59%
Thomson et al.		Scotsmen(Scotland)	63%
Thomson et al.		Irish	66%
Nakano et al.	1923	Chinese	51.9%.
Loth et al.	1931	Blacks	52.4%
Mori et al.	1964	Japanese	53.4%
Farias et al.	2011	Brazilian	73.33%
Guerra et al. (fetal)	2012	Brazilian	40.91%
Current study	2014	Indians	65 %

football players where the muscle often gets strained while playing with feet off the ground. It leads to pain in inguinal region extending towards the abdominal wall & testis, interfering with their ability to run, or jump (13).

Standard textbooks of anatomy reported the muscle to be frequently absent. The frequency of psoas minor muscle in human beings is probably influenced by ethnic and racial characteristics (7). Morphology of psoas minor also varies with its frequency. In a study by Rickenbacker, Landholt and Theiler (1985), psoas minor muscle was absent in 50% of individuals. Anson (1966) reported the muscle to be absent in 41% of adult individuals while Williams (1995) found that this percentage could be over 50% (14,15,16). In our study, the frequency of absence was as high as 60%

which was lower compared to an earlier study by Farias et al. who found it to be absent in 73.33% (17).

Racial difference has been observed in two previous studies. Bergman and Afifi (1997) reported that the percentage of absence of muscle was 57% in Whites and 66.6% in Blacks, while Hanson, Magnusson, Sorensen et al. (1998) reported 91% absence in Blacks and only 13% in Whites (18,19). However, it is worth to note that in our study, race was not considered. Table 3 stated the percentage of absence of psoas minor muscle in different ethnic population (16, 20, 21).

Many variations have been reported in morphology of psoas minor muscle in relation to its belly shape, origins and insertions associated with gender, race and

population. With respect to the origin, the tendon may split and send an extension to the fifth lumbar vertebra, first sacral vertebra and to iliopectineal line. The variations of insertions on the inguinal ligament, femoral neck and lesser trochanter of the femur together with the psoas major muscle have been reported. Sometimes its insertion may also be continuous with the pelvic fascia or directly with the iliac fascia. The study by Testut & Latarjet (1976) showed that the psoas minor muscle may be in the form of one or two tendons only (3,18,22). The psoas minor muscle fibers are vulnerable to stress overload when lateral fibers of the psoas minor tendon join the iliac fascia. These fibers can extend to the lesser trochanter, which can then act across the hip joint. The tightness of the muscle would increase with extension of the thigh. The shortened muscle, by producing abnormal lumbar curvature would limit pelvic motion. Myofascial trigger points in the psoas minor may contribute to the pain, tenderness, and muscle shortening (13). Considering the above facts, the functional role of the psoas minor muscle cannot be overlooked.

Limitation of the current study was that sample size was less (20 cadavers). Also the fetal specimens were not included in this study, which could have given proper idea about time development of the muscle.

### Conclusion

The presence or absence of psoas minor muscle may be of academic interest as the standard text books of Anatomy hardly mentions about this muscle. The clinical significance of psoas minor in sports medicine, especially in athletes like professional Golfers & football players cannot be undermined. Not only Anatomists but psoas minor may be of particular interest to Physiotherapists and Orthopedic Surgeons in reference to psoas minor syndrome. This study provides valuable information for further studies on psoas minor muscle. We suggest that the analysis of a greater number of cadavers could be more helpful along with the aid of imaging modalities such as magnetic resonance imaging (MRI) and sonography. Our study can create renewed interest to have a relook at psoas minor muscle and its clinical significance.

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