https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

Origin and Distribution of the Lumbosacral Plexusin *Sus scrofa* (Mammalia:Suidae)

Lázaro Antônio dos Santos[1], Lorena Tannus Menezes[2], Lucas Assis Ribeiro[1], Frederico Ozanam Carneiro e Silva1, FredericoBalbino Lizardo[2],Zenon Silva[3], Roseâmely Angélica de Carvalho Barros[3], Daniela Cristina de Oliveira Silva[2*]

[1]Faculty of Veterinary Medicine, Federal University of Uberlandia, Uberlândia, MG, Brazil.
[2] Institute of Biomedical Sciences, Federal University of Uberlândia, Uberlândia, MG, Brazil.
[3] Biotechnology Academic Unit, Biological Sciences Nucleus, Federal University of Goiás, Catalão, Brazil.

*Corresponding author:
Dra. Daniela Cristina de Oliveira Silva
Laboratory of Comparative Anatomy, Federal University of Uberlandia: Pará Avenue 1720, Campus Umuarama, 38400-902, Uberlandia, MG, Brazil. Tel.: +55 34 3225 8475; +55 34 99171 0898; *E-mail* address: dcosilva@ufu.br, ORCID: 0000-0001-6931-5746

***Abstract*—** *The aim of the present study was describe the origin and distribution of the lumbosacral plexus of Sus scrofa. Thirty specimenswere fixed in 10% formalin solution and prepared according to the macroscopic dissection procedures.TheSus scrofa presented five (40%) or six (60%) lumbar vertebrae and the plexus was derived from L2 to S4 spinal nerves.Eight nerves were originated from the plexus and distributed to the pelvic limb: (1) lateral femoral cutaneous, from L2-L4, branched in the psoas minor, psoas major and internal abdominal oblique muscles; (2) femoral, from L3-L6, supplied the psoas major, psoas minor, iliacus, pectineus and quadriceps femorismuscles; emitted the saphenous nerve that innervates the sartorius muscle; (3) obturator, from L3-L6, distributed to the gracilis, obturator externus, pectineus and adductor muscles; (4) cranial gluteal, from L4-S1,branched the middle gluteal and piriformis muscles; (5) caudal gluteal, from L6-S2, supplied the superficial gluteal muscle; (6) sciatic, from L4-S2, innervated the tensor fasciae latae, middle, accessory and deep gluteal, semitendinosus, semimembranosus, biceps femoris, piriformis, gemelli and quadratus femoris muscles; emitted the (a) tibial nerve, that innervates the caudal muscles of the leg and divided into medial and lateral plantar nerves, terminating as plantar digital nerves; (b) common fibular nerve, divided into superficial and deep fibular nerves, that supplied the cranial and lateral muscles of the leg, terminating as dorsal digital nerves; (7) pudendal, from S2-S4, distributed to perineal muscles; emitted the dorsal nerves of clitoris and penis; (8) caudal rectal, from S2-S4, branched to perineal muscles.*

***Keywords*— Anatomy, Artiodactyla, Pelvic limb, Spinal nerves, Wild boar.**

I. INTRODUCTION

Wild boars (*Sus scrofa* Linnaeus, 1758) are mammals belonging to the Suidae family, originating in Europe, Asia and North Africa, but they can now be found in several oceanic islands and on all continents, except Antarctica **[1]**. Although belonging to the same family, there are several differences between the domesticated pig and the wild boar. The latter possesses the horsehair and long hairs, the length of the thoracic limbs is slightly larger than pelvic limbs, in addition to be a taller and shorter animal **[2]**.

The lumbosacral plexus consists of the ventral branches of the spinal lumbar and sacral nerves **[3]**. Dyce et al.(2010) **[4]**described that the lumbosacral plexus in dogs is responsible for the innervations of the pelvic limbs and is formed from the ventral branches of the fourth (L4), fifth (L5), sixth (L6) and seventh (L7) lumbar spinal nerves, and from the ventral branches of the first (S1) and second (S2) sacral spinal nerves, whereas in the swine the nerves of this plexus are originated from the ventral branches of the third lumbar spinal nerve (L3) to the third sacral spinal nerve (S4) **[5]**.

The knowledge of the formation and composition of this plexus is important to understand anatomical, physiological, and postural aspects as well as to contribute with other studies of Comparative Anatomy, providing important data for anesthetic, surgical and clinical procedures. Therefore, the aim of this study is to

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

describe the origin and distribution of the lumbosacral plexus nerves of *Sus scrofa*.

II. MATERIAL AND METHODS

Thirty specimens of *Sus scrofa*, 13 female and 17 male, belonging to the Laboratory of Animal Anatomy, Faculty of Veterinary Medicine, Federal University of Uberlandia, Minas Gerais state, Brazil, were used in this study. The animals were hybrids and derived from the crossing of different wild boar subspecies**[6]**.

The specimens were fixed in 10% formalin solution through the aorta artery and stored in containers containing this same solution. The animals were prepared according to the macroscopic dissection procedures **[3]**. Initially, a longitudinal incision was made along the ventral midline, from the xiphoid cartilage of the sternum xiphoid process to the caudal margin of the pubic symphysis. Two other transverse incisions were made parallel to the cranial margin of each antimere until reaching the dorsal median line; a longitudinal section was made on the pubic symphysis, which was then disarticulated, and the abdominal and pelvic viscera as well as adipose tissue of these regions were removed for the visualization of the ventral branches of the lumbar and sacral spinal nerves of both antimeres. After identifying the spinal nerves of the lumbosacral plexus on both the right and left antimeres, the skin and subcutaneous fascia of the gluteal region, medial and lateral regions of the thigh and leg, anddorsal and plantar regions of the foot, were rebounded in order to analyze the distributions and ramifications of the nerves.

For the visualization of structures, a magnifying glass of eight times was used when necessary, and the nomenclature adopted for descriptions of the anatomical structures was according to the Nomina Anatomica Veterinaria **[7]**. The documentation was done by means of photographic camera (Nikon 18 mega pixels) and schemes, illustrating the origins and distribution of nerves.

For statistical analysis, the data concerning the origins of nerves in both antimeres were analyzed in a descriptive way in terms of simple percentage. This study was approved by the Ethics Committee on the Use of Animals (CEUA) of the Federal University of Uberlandia, under the protocol CEUA /UFU 103/13.

III. RESULTS

There were variations in the number of lumbar vertebrae in *Sus scrofa*, showing six lumbar vertebrae in 18 specimens and five ones in 12 animals. In all animals, four sacral vertebrae were found.The formation of the lumbosacral plexus in all specimens occurred through the connections between the ventral branches of the lateral cutaneous femoral, femoral, obturator, cranial gluteal, caudal gluteal, sciatic, pudendal and caudal rectal nerves (Figs. 1 and 2).

The variations in the number of lumbar vertebrae were determinant for the diversification of the origins of the nerves that constitute the lumbosacral plexus and consequently for its disposition. In animals with six lumbar vertebrae, the ventral branches of L3 to S3 spinal nerves contributed to the formation of the lumbosacral plexus, whereas in animals with five lumbar vertebrae this formation was originated from L2 to S3. However, there was participation of S4 in two specimens (6.7%), one female and one male, presenting five lumbar vertebrae (Fig. 1).

The lateral cutaneous femoral nerve fiberswere originated from L3/L4 in 17 (56.7%), L2/L3 in 11 (36.7%), and L2/L3/L4 in two (6.7%) specimens (Figs. 1A and 2).Thus, there was participation of L3 in 60 (100%), L4in 38 (63.3%) and L2 in 26 (43.3%) antimeres in the lateral cutaneous femoral nerve composition. Regarding itsdistribution, branches were sent to the psoas minor, psoas major and internal abdominal oblique muscles, subiliac lymphnodes, fascia and skin of the knee jointregion in all animals.

The femoral nerve was originated from L4/L5 in 21 (70%), L3/L4 in six (20%),L3/L4/L5 in two (6.6%) and from L4/L5/L6 in just one (3.3%)specimens (Figs. 1C, 2 and 7B). Therefore, the femoral nerve was derived from L3 to L6, with predominance of L4 and L5; there was participation of L4 in 60 (100%), L5 in 48 (80%), L3 in 16 (26.7%) and L6 in two (3.3%) antimeres in its composition.In all specimens,the femoral nerve sent branches to the psoas major, psoas minor, iliacus and pectineus muscles; then, emitted the saphenous nerve and finally distributed to the quadriceps femoris muscle (rectus femoris, vastus intermedius, vastus medialis and vastus lateralis muscles)(Fig. 3A). The saphenous nerve sent branches to the sartorius muscle and continued distally and medially to the thigh and the leg; at the level of the middle third of the leg, it was divided into medial and lateral branches. The medial branch distributed to the fascia of the caudal region of the leg, while the lateral branch accompanied the extension of the leg to the tarsal joint,dividing into medial, intermediate and lateral branches. The medial branch reached the fascia and skin on the metatarsal bone II; the intermediate branch innervated the dorsal region of the tarsal and metatarsal joints; and the lateral branch sent terminal branches to the fascia and skin of these joints.

The obturator nerve was originatedfrom L4/L5 in 18 (60%),L3/L4/L5 in 10 (33.3%),L3/L4 in one (3.3%) and L4/L5/L6 in one (3.3%) specimens (Figs. 1D, 2 and 7B). In this way, the roots that constituted the obturator nerve

https://dx.doi.org/10.22161/ijaers.6.3.8 ISSN: 2349-6495(P) | 2456-1908(O)

were derived from L3 to L6, with predominance of L4 and L5; on rare occasions, from L3 and L4 or with contributions of L3 or L6.Therefore, there was participation of L4 in 60 (100%), L5 in 58 (96.7%), L3 in 22 (36.7%) and L6 in two (3.3%) antimeres in the obturator nerve composition. Aboutthe distribution, the obturator nerve supplied the gracilis, obturator externus and adductor muscles in all animals (100%), whereas branches were sent to the pectineus muscle in 72% of the cases(Fig. 3A).

The cranial gluteal nervefibers were originated from L5/L6 in 16 (53.3%), L5/S1 in eight (26.7%), L4/L5 in four (13.3%) and L6 in two (6.7%) specimens (Figs. 1B).In this manner, there was participation of L5 in 56 (93.3%), L6 in 36 (60%), S1 in 16 (26.7%) and L4 in eight (13.3%)antimeres in the cranial gluteal nerve composition.Concerning the distribution, in a short course, the cranial gluteal nerve leaved the pelvic cavity through the sciatic foramen and sent branches to the middle gluteal and piriformis muscles in 100% of the cases.

The caudal gluteal nerve was originated from S1/S2 in 20 (66.7%), L6/S1 in five 16.7%) and S1 in five (16.7%) animals (Figs. 1G).Thus, there was participation of S1 in 60(100%), S2 in 40 (66.7%), and L6 in 10 (16.7%)antimeres in the caudal gluteal nerve composition and its distribution was verified only to the superficial gluteal muscle (Fig. 3B).

The sciatic nervefibers were originated from L5/L6/S1/S2 in 17 (56.7%), L4/L5/S1/S2 in eight (26.7%), L5/S1/S2 in four (13.3%) and L5/L6/S1 in one (3.3%) animals (Figs. 1F, 2 and 7B). Therefore, there was participation of L5 and S1 in 60 (100%), S2 in 58 (96.7%), L6 in 36 (60%) and L4 in 16 (26.7%)antimeres in the sciatic nerve composition. Regarding the distribution, the sciatic nerve, along its course, emitted branches to the tensor fasciae latae, middle gluteal, accessory gluteal,deep gluteal, semitendinosus, semimembranosus, biceps femoris and piriformis muscles in all antimeres (100%) (Fig. 3A). At the level of the greater trochanter of the femur bone, the sciatic nerve curved ventrally and emitted a branch to the gemelliand quadratus femoris muscles. In 100% of the animals, a thin branch was originated from the caudal margin of the sciatic nerve, named caudal cutaneous femoral nerve, which was distributed in the skin of the caudal region of the thigh over the origin of the semitendinosus and biceps femoris muscles (Fig. 3B). It is noteworthy the presence of a branch communicating of the sciatic nerve with the pudendal nerve in all the specimens.

Distally in the caudomedial part and middle third of the thigh, the sciatic nerve divided into tibial and common fibular nerves (Fig. 3B).In all specimens, the tibial nerve gave off branches to the gastrocnemius, soleus, popliteus, superficial digital flexor, tibialis caudalis, lateral flexor, and medial flexor (deep digital flexor) muscles (Fig. 4A). In the distal part of the leg, it divided into the medial and lateral plantar nerves. The medial plantar nerve followed in the plantar region, and divided into medial and lateral branches at the level of the tarsal joint. The first branch is called the common plantar digitalnerve II, which emitted the properplantar digital nerve II and continued as the abaxial proper plantar digital nerve III; the second branch is the common plantar digital nerve III, which before dividing into axial proper plantar digital nerves III and IV, emitted a branch communicating with the proper plantardigital nerve V (Figs. 4B and C). The lateral plantar nerve, in an oblique course, passed under the plantar ligament of the tarsus and accompanied the lateral margin of the superficial muscles of the digits; in the distal third of the tarsus, sent branches to the interosseous muscles, continued as common plantardigital nerve IV, and near the metatarsophalangeal joint, emitted the proper plantardigital nerve V, continuing as the abaxial proper plantar digital nerve IV(Figs. 4B and C).

The tibial nerve originated the lateral sural cutaneous nerve in 27% of the cases, whereas this latter nerve was derived from the common trunk of the sciatic nervein 73% of the cases. The lateral cutaneous sural nerve descended in the lateralmiddle direction along the caudal surface of the gastrocnemius muscle, and in the lateral region of the tarsus it gave off branches to the skin (Fig.5A).

The common fibular nerve crossed the lateral head of the gastrocnemius muscle, perforated the soleus muscle, and on the proximal part of the tibia divided into the superficial and deep fibular nerves (Fig. 5A). At the level of the tarsal joint, the superficial fibular nerve, relatively thickerthan the deep fibular nerve, gave off several branches to fascia and skin of this region and then divided into medial, intermediate and lateral branches. The medial branch continued as the common dorsal digital nerve II, which emitted the proper dorsaldigital nerve II and followed distally as abaxial proper dorsaldigital nerve III (Figs. 5B and C). The intermediate branch followed along the dorsal region of the foot; at the level of the metatarsophalangeal joint, it communicated with the dorsal metatarsal nerve III to constitute the common dorsal digital nerve IIIand then divided into axial proper dorsaldigital nerves III and IV (Fig. 5B). The lateral branch, called the common dorsal digital nerve IV, emitted the proper dorsal digital nerve V and continued as abaxial proper dorsaldigital nerve IV (Figs. 5B and D).At the proximal third of the leg, the deep fibular nerve sent branches to the tibialis cranialis, fibularistertius, extensor digitorum longus,fibularis longusand lateral digital

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

extensor muscles.The deep fibular nerve went throughthe sulcus between the fibularis longusand the lateral digital extensormuscles (Fig. 5A); at the metatarsal region continued as dorsal metatarsal nerve III, which after emerging between the tendons of the flexor digitorum longus muscle, joined the common dorsal digital nerve III (Fig. 5B). In 5antimeres (8.33%) a communicating branch between the deep fibular nerve and the common dorsal digital nerve II was found (Figs. 6A and B).

The pudendal nerve was originated from S2/S3 in 28 (93.3%), and S2/S3/S4in two (6.7%)specimens (Figs. 1E and 2). In this way, there was participation of S2 and S3 in 60 (100%) and S4 in four (6.7%) antimeres in the pudendal nerve composition. The pudendal nerve emitted perineal branches to theexternal analsphincter, levator ani, constrictor vulvae, ischiocavernosus and bulbospongiosus muscles (Figs. 7A and B). In addition, the pudendal nerve originated the dorsal nerve of clitoris and mammary branches, which innervate the clitoris and skin of the vulvar region, respectively, and the dorsal nerve of the penisthat was distributed in the penis glans, forskin, and scrotum in all animals (Figs. 7A and B).

The caudal rectal nerve was originated from S2/S3 in 28 (93.3%), and S2/S3/S4 in two (6.7%) animals (Fig 1E). Thus, there was participation of S2 and S3 in 60 (100%) and S4 in four (6.7%) antimeres in the caudal rectal nerve composition. In its course, the caudal rectal nerve sent branches to the levator ani, coccygeus and external anal sphincter muscles in 100% of the animals (Fig. 7B).

Table 1 summarizes the origin, participation and distribution of the ventral branches of spinal nerves that constitute the lumbosacral plexus in *Sus scrofa* andTable 2 summarizes the branches of these nervesand its distribution to muscles e organs.

Table 1. Origin, participation and distribution ofthe ventral branches of spinal nerves that constitute the lumbosacral plexus in Sus scrofa.

Nerves	Origin N (%) animals	Participation N (%) antimeres	Distribution to muscles and organs
Lateral femoral cutaneous	L3/L4 – 17 (56.7%) L2/L3 – 11 (36.7%) L3/L4 – 2 (6.6%)	L3 – 60 (100%) L4 – 38 (63.3%) L2 – 26 (43.3%)	psoas minor, psoas major and internal abdominal oblique muscles; subiliac lymph nodes, fascia and skin of the knee joint region
Femoral	L4/L5 – 21 (70%) L3/L4 – 6 (20%) L3/L4/L5 – 2 (6.6%) L4/L5/L6 – 1 (3.3%)	L4 – 60 (100%) L5 – 48 (80%) L3 – 16 (26.7%) L6 – 2 (3.3%)	psoas major, psoas minor, iliacus, quadriceps femoris, pectineus muscles
Obturator	L4/L5 – 18 (60%) L3/L4/L5 –10 (33.3%) L3/L4 – 1 (3.3%) L4/L5/L6 – 1 (3.3%)	L4 – 60 (100%) L5 – 58 (96.7%) L3 – 22 (36.7%) L6 – 2 (3.3%)	gracilis, obturator externus and adductor muscles (100%); pectineus muscle(72%)
Cranial gluteal	L5/L6 – 16 (53.3%) L5/S1– 8 (26.7%) L4/L5 – 4 (13.3%) L6 – 2 (6.7%)	L5 – 56 (93.3%) L6 – 36 (60%) S1 – 16 (26.7%) L4 – 8 (13.3%)	middle gluteal and piriformis muscles
Caudal gluteal	S1/S2 – 20 (66.7%) L6/S1 – 5 (16.7%) S1 – 5 (16.7%)	S1 – 60 (100%) S2 – 40 (66.7%) L6 – 10 (16.7%)	superficial gluteal muscle
Sciatic	L5/L6/S1/S2 – 17(56.7%) L4/L5/S1/S2 – 8 (26.7%) L5/S1/S2 – 4 (13.3%) L5/L6/S1 – 1 (3.3%)	L5/S1 – 60 (100%) S2 – 58 (96.7%) L6 – 36 (60%) L4 – 16 (26.7%)	tensor fasciae latae, middle gluteal, accessory gluteal, deep gluteal, gemelli, quadratus femoris, piriformis, semitendinosus, semimembranosus, biceps femoris muscles
Pudendal	S2/S3 – 28 (93.3%) S2/S3/S4 – 2 (6.7%)	S2/S3 – 60 (100%) S4 – 4 (6.7%)	external anal sphincter, levator ani, constrictor vulvae, ischiocavernosus and bulbospongiosus muscles
Caudal rectal	S2/S3 – 28 (93.3%) S2/S3/S4 – 2 (6.7%)	S2/S3 – 60 (100%) S4 – 4 (6.7%)	levator ani, coccygeus, external anal sphincter muscles

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

Table 2. Branches of the nerves that constitute the lumbosacral plexus in Sus scrofa and its distribution to muscles e organs.

Nerves	Branches	Distribution to muscles e organs
Lateral femoral cutaneous	None	-
Femoral	Saphenous: • medial branch • lateral branch: ▪ medial branch ▪ intermediate branch ▪ lateral branch	Sartorius muscle • fascia of the caudal region of the leg ▪ fascia and skin on the metatarsal bone II ▪ dorsal region of the tarsal and metatarsal joints ▪ fascia and skin of the tarsal and metatarsal joints
Obturator	None	-
Cranial gluteal	None	-
Caudal gluteal	None	-
Sciatic	Caudal cutaneous femoral	Skin of the caudal region of the thigh
	Lateral sural cutaneous	Skin of the leg caudal surface and lateral region of the tarsus
	Tibial: • medial plantar ▪ common plantar digital II - proper plantar digital II ○ abaxial proper plantar digital III ▪ common plantar digital III - axial proper plantar digital III - axial proper plantar digital IV • lateral plantar ▪ common plantar digital IV - proper plantar digital V ○ abaxial proper plantar digital IV	Gastrocnemius, soleus, popliteus, superficial digital flexor, tibialis caudalis, lateral flexor, and medial flexor (deep digital flexor) muscles • interosseous muscles
	Common Fibular: • superficial fibular ▪ medial branch - common dorsal digital II ○ proper dorsal digital II ➢ abaxial proper dorsal digital III ▪ intermediate branch - common dorsal digital III ○ axial proper dorsal digital III ○ axial proper dorsal digital IV ▪ lateral branch - common dorsal digital IV ○ proper dorsal digital V ○ abaxial proper dorsal digital IV	• fascia and skin of the tarsal region
	• deep fibular ▪ dorsal metatarsal III	• tibialis cranialis, fibularis tertius, extensor digitorum longus, fibularis longus and lateral digital extensor muscles

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

	Dorsal nerve of the clitoris	Clitoris and skin of the vulvar region
Pudendal	Dorsal nerve of the penis	Penis glans, forskin and scrotum
	Mammary branches	
Caudal rectal	None	-

IV. DISCUSSION

Origin of the lumbosacral plexus

There was a wide variation in the origin of the nerves constituting the lumbosacral plexus in *Sus scrofa*. One of the determining factors was the inconstancy in the number of lumbar vertebrae, as reported in swine **[8],** domestic pig of the AG-1050 lineage**[9],** Zebu-crossed bovine fetuses**[10]** and wild boar**[11]**.

In the present study, the findings of six lumbar vertebrae in 18 (60%) specimens of *Sus scrofa*were similar to the reports in swine **[12, 13]**, whereas the results of five lumbar vertebrae found in 12 specimens (40%)were also described by Ghoshal (1986c)**[14]**in swine and Rosa (2012)**[15]** in Pen Ar Lan swine. However, no variations of these structures were found in wild boar **[16, 17]**.Thus, the composition of the lumbosacral plexus in *Sus scrofa* specimens that presented six lumbar vertebrae occurs from L3 to L6 and from S1 to S3, similarly to the reports in swine **[5]**, whereas in animals with five lumbar vertebrae it occurs from L2 to S3. However, in two (6.6%) specimens with five lumbar vertebrae there was participation of S4, findings that agreed in part with Ghoshal (1986a,c)**[14, 18]** in equine and swine, who described that this plexus extended from L3 to S4 and not referring to the participation of L2. Frandson (1979)**[19]** reportedthat the lumbosacral plexus formation in swine occurs from the last three lumbar spinal nerves and the first sacral spinal nerve, whereas Godinhoet al. (1987) **[3]** mentioned its composition from L4 to S4 in ruminants.

Lateral femoral cutaneous nerve

The origin of the lateral femoral cutaneous nerve from L3 and L4 in 56.7% of *Sus scrofa* specimens was in agreement with reports in ruminants **[5]**, equine**[18]**and swine **[14]**. According to Königet al. (2011)**[20]**, the main contribution to the formation of this nerve in equine was from L4, but in animals with five lumbar vertebrae, its formation occurred from L2 and L3 and from L2 to L4. In contrast, L5 fibers may be present in the composition of this nerve in ruminants **[3]**and are the main contribution to its formation in swine **[5]**.

The distribution of the lateral femoral cutaneous nerveto thepsoas minor, psoas majorand internal abdominal oblique muscleswasin accordance with descriptions in swine**[14]**. In ruminants, however, this nerve sends branches to the quadratus femoris and iliacusmuscles**[3]**,whose distribution wasnot found in the specimens of the present study.

Femoral nerve

The femoral nerve in *Sus scrofa* showedvaried origins: from L4 and L5 in 70% of animals as described in ruminants**[12]**, swine**[8]**, Zebu-crossed bovine fetuses**[21]**and Saanen goats**[22]**; from L3 and L4 in 20% of animals, in partial concordance with reports of Sisson and Grossman (1975)**[12]** in ruminants, Ghoshal (1986c)**[14]** in swine and Moraes et al. (2008)**[23]** in equine, who mentionedits origin from L3 to L6; from L3 to L5 in 6.6% of animals as reported by Moraes et al. (2008)**[23]** in equine; from L4 to L6 in 3.3% of animals, as describedin ruminants **[4, 5, 24]**,dogs**[25]**, swine [8], equine **[23]**, Zebu-crossed bovine fetuses**[21]** and Pen Ar Lan swine**[15]**.

It is noteworthy that the femoral nerve rarely presented contribution of L3 or L6 in ruminants **[12]**,equine**[12, 18]**, dogs **[26]** and swine **[14]**; these data were in agreement with the findings of *Sus Scrofa* specimens studied, which showed a minor contribution of L3 (26.6%) and a minimal of L6 (3.3%) in the femoral nerve composition. On the other hand, Mihelic et al. (2004)**[8]** mentioned that this nerve may have origin from L6 and L7 in swine.

The distribution of the femoral nervein *Sus scrofa* to the psoas major, psoas minor, iliacus and quadriceps femoris muscles was similar to that seen in ruminants**[3-5, 24]**. Branches of this nerve to the pectineus muscle in all the studied specimens were also found in Zebu-crossed bovine fetuses**[21]**.

The saphenous nerve, a branch of the femoral nerve, showed distribution to the sartorius muscleas described in swine **[14]**. Conversely, the branch of saphenous nerve that joins to the medial branch of the superficial fibular nerve to constitute the common dorsal digital II nerve as described in swine **[14]**was not found in*Sus scrofa*.The distribution of the saphenous nerveterminal branches to the metatarsal bone II, tarsal and metatarsal joint regionswereequivalentto those described in swine**[14]**.

Obturator nerve

The origin of the obturator nerve in *Sus scrofa* showed four variations: (1) from L4 and L5 in 60% of specimens, in agreement with reports ofSchwarze and Schröder (1970) **[5]**in ruminants, Sisson and Grossman (1975) **[12]**and Ghoshal (1986a)**[18]**in equine, Ghoshal

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

(1986c)**[14]** in swine, and Chagas et al. (2006)**[9]** in domestic pig of the AG-1050 lineage; (2) from L3 to L5 in 33.3% of animals, similar to ruminants **[27]** and swine **[14]**; (3) from L3 and L4 in 3.3% of specimens, in accordance with descriptions of Bruni and Zimmerl (1977)**[27]** in donkey; (4) from L4 to L6 in 3.3% of animals as described in ruminants **[24]**, dogs **[25]**, swine**[8]**, and domestic pig of the AG-1050 lineage **[9]**.

Godinho et al. (1987)**[3]** described fibers originating only from L5 and L6 in the composition of the obturator nerve in ruminants, but in the studied specimens of *Sus scrofa* there was additional contribution of L4. Miranda et al. (2007) **[10]**reported that the formation of the obturator nerve occurs from L5 and S1, L5, L6 and S1, and L6 and S1 in Zebu-crossed bovine fetuses; however, these descriptions were not observed in the animals of present study.

Altogether, the origin of the obturator nerve in *Sus scrofa* occurred mainly from L4 and L5 in disagreement with Mihelic et al. (2004)**[8]** who evidenced a greater involvement of L5 and L6 in swine. The second major contribution in the composition of this nerve in *Sus scrofa* occurred from L3 (36.6%) as described in equine **[12, 18]**. It should be noted that these diversifications in the composition of the obturator nerve are related to the animals presenting five lumbar vertebrae.

The distribution of the obturator nerve to the obturator externus, gracilis, adductor and pectineus muscles was in agreement with reports of Ghoshal (1986a,c)**[14, 18]**in equine and swine, Evans and De Lahunta (2001)**[25]** in dogs and Nascimento et al. (2013)**[22]** in Saanen goats. In contrast, Chagas et al. (2006)**[9]**, in a study with domestic pig of the AG 1050 lineage, described branches to the sartorius, quadratus femoris and semimembranosus muscles, whose distribution was not observed in any *Sus scrofa* specimens analyzed.

Cranial gluteal nerve

The originof the cranial gluteal nerve in *Sus scrofa* predominantly from L5 and L6 (53.3% of specimens) was in accord with reports of Godinho et al. (1987) **[3]** in ruminants, in which this nerve was derived principally from L6. On the other hand, Ghoshal (1986b)**[24]** has found contribution of L6 and S1 in the formation of the cranial gluteal nerve in ruminants, whereas some authors have described a occasional participation of L5 in addition to L6 and S1 in ruminants**[5]** and equine **[18]**. In dogs and cats, the cranial gluteal nerve has arisen from L6 and L7**[28]**, findings not evidenced in this study. Ghoshal (1986c)**[14]** has described the cranial gluteal nerve as a branch of the sciatic nerve in swine, but the Nomina Anatomica Veterinaria (2017)**[7]**mentions it separately.

In *Sus scrofa*, the cranial gluteal nerve sent branches to the middle gluteal and piriformis muscles, as reported by Ghoshal (1986c)**[14]** in swine and Godinho et al. (1987)**[3]** in ruminants. However, cranial gluteal nerve fibers to the tensor fasciae latae and deep gluteal muscles were not verified in *Sus scrofa* asdescribed by Ghoshal (1986b)**[24]** in ruminants.

Caudal gluteal nerve

The origin the caudal gluteal nerve in *Sus scrofa* from S1 and S2 in 66.7% of specimens was comparable to the reports of Ghoshal (1986b) **[24]** in ruminants. The contribution of S1 was observed in all specimens analyzed in agreement with Evans and De Lahunta (2001)**[25]** in dogs. The contribution of S3, as mentioned by Ghoshal (1986d) **[28]** in dogs, L6, L7 and S1 or L6 and L7 by Evans and De Lahunta (2001)**[25]** in dogs, was not found in *Sus scrofa* specimens. There are no reports in the literature about the participation of L6 and S1 in the composition of this nerve, as observed in 16.7% of *Sus scrofa* specimens of this research.

The supply of the caudal gluteal nerve to the superficial gluteal muscle was similar reported by Ghoshal (1986b,d) **[24, 28]**in ruminants and dogs. However, branches of this nerve to the piriformis and middle gluteal muscles as seen in dogs **[28]** and to the middle gluteal and biceps femoris muscles as described in ruminants **[3]**were not found in *Sus scrofa* specimens.

Sciatic nerve

The fibers of the sciatic nerve in *Sus scrofa* originated from L5, L6, S1 and S2 in 56.7% of specimens were also observed in ruminants **[27]**, swine **[14]**, Zebu-crossed bovine fetuses **[29]**, equine **[4]** and Pen Ar Lan swine fetuses **[30]**. Another composition of this nerve with fibers originating from L5, L6 and S1 in only 3.3% of specimens was also reported in ruminants**[27]** and Pen Ar Lan swine fetuses **[30]**. Inanimalswith five lumbar vertebrae, the contribution of L4 was seen in 26.7% of *Sus scrofa* specimens, similar to that described in swine **[14]**.

In contrast, there are reports describing that S3 fibers contributed to sciatic nerve formation in swine **[14]** and Zebu-crossed bovine fetuses**[31, 32]**, but this description did not occur in the animals of this study. Several studies have reported that the fibers of the sciatic nerve can originate from L6, S1 and S2 in equine**[12]**, ruminants **[3, 5, 20, 27]**, Zebu-crossed bovine fetuses **[29]**; this arrangement, however, was not found in *Sus scrofa* specimens studied, but from L5, S1 and S2 in 13.3% of animals.

When analyzing the participation of the ventral branches of the spinal nerves in the sciatic nerve formation in *Sus scrofa*, the greater contribution was essentially from the last lumbar spinal nerve and first sacral spinal nerve in 100% of specimens, similar to that

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

seen in ruminants **[5, 24]** and Zebu-crossed bovine fetuses**[29]**.

Regarding the distribution of the sciatic nerve, branches to the semitendinosus, semimembranosus and biceps femoris muscles found in all *Sus scrofa* specimens were also reported in ruminants **[3, 5, 12]**, equine and swine**[14, 18]**, dogs **[25]** and Zebu-crossed bovine fetuses **[32]**. Also, branches to the gemelli and quadratus femoris muscles were seen in ruminants **[3, 5, 12]**, dogs**[24-26]**, cats **[33]** and equine **[4]**, whereas branches to the middle gluteal and deep gluteal muscles were described in ruminants **[24]** and Zebu-crossed bovine fetuses **[32]**, corresponding to the findings in all *Susscrofa* specimens. Finally, branches to the piriformis and tensor fasciae latae muscles found in all studied specimens were reported respectively in cats **[33]** and ruminants **[3]**.

Divergentfromthe findings in *Sus scrofa*, sciatic nerve fibers were sent to the adductor muscle in ruminants**[3, 12]**, swine **[14]** and Zebu-crossed bovine fetuses **[32]**; this muscle was supplied by the obturator nerve in *Sus scrofa* specimens studied. In addition, branches of the sciatic nerve were sent to the pectineus muscle in swine **[14]** whereas this muscle was supplied by the femoral and obturator nerves in *Sus scrofa* specimens.

In *Sus scrofa*, the sciatic nerve emitted two cutaneous branches during its course: the caudal cutaneous femoral nerve in 100% of specimens analyzed, similar to the citations of Ghoshal (1986b)**[24]** in ruminants and ovine; and the lateral sural cutaneous nervein 73% of the animals studied, differently from the findings in dogs **[26]**, ruminants **[24]** and equine **[18, 20]**. A communicant branch of the sciatic nerve with the pudendal nerve was alsoobserved in all *Sus scrofa* specimens, in agreement with the findings in swine **[14]** and cats **[28, 33]**.

As terminal branches of the sciatic nerve, the tibial and common fibular nerves were observed in all *Sus scrofa* specimens studied. The distribution of the tibial nerve to the gastrocnemius, soleus, popliteus, and superficial and deep digital flexor muscles as well as its division in medial and lateral plantar nerves are in concordance with those reported in ruminants and swine **[14, 24]**. The medial plantar nerve and its division in medial branch – continuing as the common plantar digital II, proper plantar digital II and abaxial proper plantar digital III – and lateral branch – continuing as common plantar digital III, axial proper plantar digital III and IV – were similar to the reports in swine**[14]**. Likewise, the lateral plantar nerve and its division in common plantar digital IV, proper plantar digital V and abaxial proper plantar digital V were also seen in swine **[14]**. The presence of a communicating branch between the medial and lateral plantar nerves observed in *Sus scrofa* specimens was also described in ruminants and swine **[14, 24]**.

The division of the common fibular nerve of *Sus scrofa*in superficial and deep fibular nerves was comparable to those found in swine **[14]**. The superficial fibular nerve and its division in medial branch – continuing as the common dorsal digital II, proper dorsal digital II and abaxial proper dorsal digital III – intermediate branch – continuing as common dorsal digital III, axial proper dorsal digital III and IV – and lateral branch – continuing as common dorsal digital IV, proper dorsal digital V and abaxial proper dorsal digital IV – were similar to the reports in swine **[14]**. In contrast, Ghoshal **[14]** described in swine a communicating branch between the saphenous nerve and the common dorsal digital nerve II as well as a nerve originated from the lateral branch of the superficial fibular nerve, namely the lateral dorsal digital nerve V, which were not found in the *Sus scrofa* specimens analyzed.

The distribution of the deep fibular nerve to the tibialis cranialis, fibularis tertius, fibularis longus and lateral digital extensor muscles was also observed in ruminants **[24]** and equine**[34]**. Its continuation at the metatarsal region as dorsal metatarsal nerve III and its junction with the common dorsal digital nerve III were equivalent to those found in ruminants **[24]** and swine **[14]**. In addition, the communicating branch between the deep fibular nerve and the common dorsal digital nerve II seen in 8.3% of *Sus scrofa* specimens was also observed in swine**[14]**.

Pudendal nerve

The origin of the pudendal nerve from S2 and S3 in 93.3% of *Sus scrofa* specimens analyzed was concordant with that described in swine **[5, 14]**, dogs **[28]** and goats **[35]**. Likewise, Goshal (1986b)**[24]** and König et al. (2011)**[20]** reported that S3 is the main branch that participates in the formation of this nerve in ruminants. Another ventral branch of spinal nerve involved in the formation of the pudendal nerve was S4 in only 6.7% of specimens in agreement with reported in ruminants **[3, 4]**and Zebu-crossed bovine fetuses**[31]**. The origin from S1, S2 and S3 described in dogs**[4, 25]** was not observed in *Sus scrofa* specimens analyzed.

The distribution of the pudendal nerve to the external anal sphincter, levator ani, constrictor vulvae, ischiocavernosus and bulbospongiosus muscles in *Sus scrofa* was accord with the findings in swine **[14]** and ruminants**[20]**.Also, the distribution of the pudendal nerve branches, namely the dorsal nerve of the clitoris, the dorsal nerve of the penis and mammary branches, was similar to that described in ruminants**[5]**.

Caudal rectal nerve

The origin of the caudal rectal nerve from S2 and S3 in 93.3% of *Sus scrofa* specimens was concordant with

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

the data reported by Chagas et al. (2010)**[36]**in Pen Ar Lan swine. Thecontribution of S4 in the formation of the caudal rectal nerve seen inonly 6.7% of specimens was also observed in Pen Ar Lan swine **[36]**. However, Schwarze and Schröder (1970)**[5]**and Ghoshal (1986c)**[14]**reported that this nerve originated from S4 with an inconstant contribution of S3 in swine. Other studies have reported the participation of S3 and S4 in the composition of this nerve in equine **[37]** and S4 and S5 in ruminants **[3]**. In ruminants, Ghoshal (1986b)**[24]** described that this nerve was mostly originated from S4, but it can be originated from S4 and S5.

The distribution of the caudal rectal nerve to the levator ani and external anal sphincter muscles in *Sus scrofa* was similar to that described in swine **[14]** whereas the fibers to the coccygeus muscle were also observed in ruminants **[24]** and equine **[37]**.

V. CONCLUSIONS

In this study, the morphological analyze of the *Sus scrofa* lumbosacral plexus was describe, emphasizing the origin and distribution of its nerves. Summing up, considering the observations in all specimens studied, it can be conclude that the lumbosacral plexus of *Sus scrofa*is originated from L3 to S3 in animals with six lumbar vertebrae and from L2 to S4 in animals with five lumbar vertebrae. Also, eightnerves are originated from lumbosacral plexus, namely the lateral femoral cutaneous, femoral, obturator, cranial gluteal, caudal gluteal, sciatic, pudendal and caudal rectal nerves. They distribute to structures of the wall and abdominal and pelvic cavities as well as regions of the pelvic limb.

CONTRIBUTORS

Lázaro Antônio dos Santos, Lorena Tannus Manezes and Lucas Assis Ribeiro were responsible for acquisition, analysis and interpretation of data. Frederico Ozanam Carneiro e Silva and Frederico Balbino Lizardo were responsible for preparation and revision of the manuscript. Zenon Silva, Roseâmely Angélica de Carvalho Barros and Daniela Cristina de Oliveira Silva were responsible for concept and design, and for preparation of the manuscript. All authors read and approved the final version of manuscript.

CONFLITS OF INTERESTS

The authors declare no conflicts of interest associated with this manuscript.

REFERENCES

[1] Oliver WLR, Brisbin IL (1993) Introduced and feral pigs, problems, policy and priorities. In: Oliver WLR (ed) Pigs, Peccaries and Hippos, Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland, pp 179-191.

[2] Nowak RM (1999) Walker's mammals of the world. 6th edn, vol 1. The John Hopkins University Press, Baltimore and London.

[3] Godinho HP, Cardoso FM, Nascimento JF (1987) Anatomia dos ruminantes domésticos. Universidade Federal de Minas Gerais, Belo Horizonte.

[4] Dyce KM, Sack WO, Wensing CJG (2010) Tratado de Anatomia Veterinária. 4th edn. Elsevier, Rio de Janeiro.

[5] Schwarze E, Schroder L (1970) Nervios espinales. In: Schwarze E (ed) Compêndio de anatomia veterinária, sistema nervoso y órganos de los sentidos, vol 4. Acríbia, Zaragoza, pp 61-90.

[6] Silva PVC (2007) Caracterização genética de javalis por meio de marcadores microssatélites.Dissertação, Universidade Estadual Paulista "Julio de Mesquita Filho", Faculdade de Ciências Agrárias e Veterinárias, Campus de Jaboticabal, Jaboticabal, São Paulo, Brasil.

[7] I.C.V.G.A.N. International Committee On Veterinary Gross Anatomical Nomenclature. Nomina Anatômica Veterinária (2017) 6th edn. Committee Hannover, Columbia.

[8] Mihelic D, Gjurèeviæ-Kantura V, Markovinoviæ SA, Damjanoviæ A,Trbojeviæ-Vukièeviæ A (2004) Variations of formation of n. femoralis, n. obturatorius, and n. ischiaticus in pigs. Vet Arhiv 74:261-270.

[9] Chagas RG, Drummond SS, Carneiro e Silva FO, Eurides D, Alves ECM, Miranda RL (2006) Origem e distribuição do nervo obturatório em suínos (*Sus scrofa domesticus*) da linhagem AG-1050. Arq Ciên Vet Zool UNIPAR 9:15-20.

[10] Miranda RL, Carneiro e Silva FO, Severino RS, Drummond SS, Gonçalvez RC (2007) Origens e distribuições dos nervos obturatórios em fetos fêmeas de bovinos azebuados. Biosci J 23:120-127

[11] Gomes ARA, Carneiro e Silva FO, Iglesias LP, Ribeiro LA, Souza TAM, Furlan NL (2013) Origens e ramificações do nervo femoral em javalis (S*us scrofa scrofa* Linnaeus, 1758) Biosci J 29:727-731.

[12] Sisson S, Grossman JD (1975) Anatomia de los animales domésticos. 4th edn. Salvat, Barcelona.

[13] Sisson S, Hillmann DJ (1986) Osteologia do suíno. In: Getty R (ed) Sisson/Grossman anatomia dos animais domésticos, 5th edn, vol 2, chap 37. Ganabara Koogan, Rio de Janeiro, pp 1139-1173.

[14] Ghoshal NG (1986c) Nervos espinhais. In: Getty R (ed) Sisson/Grossman Anatomia dos animais domésticos, 5th edn, vol 2, chap 46. Guanabara Koogan, Rio de Janeiro, pp 1294-1307.

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

[15] Rosa LA (2012) Origem de distribuição dos nervos femorais em fetos de suínos da linhagem Pen Ar Lan (*Sus scrofa* domesticus Linnaeus, 1758). Dissertação, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brasil.

[16] Iglesias LP, Carneiro e Silva FO, Brito TR (2011) Origem e distribuição do nervo isquiático em fetos de javalis (*Sus scrofa scrofa*). Biotemas 24:141-145.

[17] Gomes ARA, Carneiro e Silva FO, Vasconcelos RYG, Santos LA, Santos ALQ (2015) Origens e distribuições do nervo obturatório em fetos de javalis (S*us scrofa scrofa* Linnaeus, 1758) Biosci J 31:527-531.

[18] Ghoshal NG (1986a) Nervos espinhais. In: Getty R (ed) Sisson/Grossman Anatomia dos animais domésticos, 5th edn, vol 1, chap 24. Guanabara Koogan, Rio de Janeiro, pp 620-642.

[19] Frandson RD (1979) Anatomia e fisiologia dos animais domésticos. Guanabara Koogan, Rio de Janeiro.

[20] König HE, Leibich HG, Cerveny C (2011) Sistema Nervoso. In: Anatomia dos animais domésticos, texto e atlas colorido, órgãos e sistemas, vol 2, chap 14. Artmed, Porto Alegre, pp 509-580.

[21] Lizardo FB, Carneiro e Silva FO, Santos LA, Bernadino Junior R, Silva DCO, Mitri FF, Rosa, LA, Guimaraes EC, Cabral LG, Sousa GC (2009) Origin and distribution of the femoral nerve in fetuses of zebu-crossed bovines. Braz JMorphol Sci 26: 91-96.

[22] Nascimento RM, Estruc TM, Pereira JLA, Scherer PO, Fiqueredo MA (2013) Origem e distribuição antimérica dos nervos obturatórios em caprinos neonatos da raça Saanen. Rev Bras Ciênc Vet 20:74-79.

[23] Moraes DV, Martins JD, Carneiro e Silva FO, Drummond SS, Severino RS (2008) Origem e distribuição do nervo femoral em equinos sem raça definida. Horizonte Científico. 1:1-10

[24] Ghoshal NG (1986b) Nervos espinhais. In: Getty R (ed) Sisson/Grossman Anatomia dos animais domésticos, 5th edn, vol 1, chap 35. Guanabara Koogan, Rio de Janeiro, pp 1052-1077.

[25] Evans HE, De Lahunta (2001) Abdome, pelve e membro pélvico. In: Evans HE (ed) Guia para a dissecação do cão, 5th edn. Guanabara Koogan, Rio de Janeiro, pp 163-169.

[26] Miller ME (1979) Miller's anatomy of the dog. 2nd edn. W.B. Sauders, Philadelphia.

[27] Bruni AC, Zimmerl U (1977) Nervispinali. In: Anatomia deglianimali dommestici, vol 2. Casa Editrice Dottor Francesco Vallardi, Milano, pp 535-564.

[28] Ghoshal NG (1986d) Nervos espinhais. In: Getty R (ed) Sisson/Grossman Anatomia dos animais domésticos, 5th edn, vol 2, chap 57. Guanabara Koogan, Rio de Janeiro, pp 1595-1617.

[29] Ferraz RHS, Lopes GR, Melo APF, Prada ILS (2006). Estudo anatômico da porção intrapélvica do nervo isquiático em fetos de bovinos azebuados. Braz J Vet Res Anim Sci43:302-308.

[30] Santos LA, Carneiro e Silva FO, Rosa LA, Menezes LT, Canabrava ACMN, Lizardo FB, Silva DCO, Sousa GC (2013) Origem e distribuição do nervo isquiático em fetos de suínos da Linhagem Pen Ar Lan (*Sus scrofa domesticus* Linnaeus, 1758). Biotemas 26:147-157.

[31] Ferraz RHS, Prada ILS (1998) Anatomical study on the distribution of the pudendal nerve in fetuses female in crossbred zebu cattle. Braz JMorphol Sci 15: 215-22.

[32] Campos DB, Carneiro e Silva FO, Severino RS, Drummond SS, Lima EMM, Bombonato PP, Santana MIS (2003) Origem e distribuição dos nervos isquiáticos em fetos de bovinos azebuados. ARS Vet 19:219-223.

[33] Guimarães GC, Machado MRF, Santos ALQ, Vieira LG, Souza AG, Silva JM, Magnino KAPS (2005). Origin and distribution of the sciatic nerve in the domestic cat (*Felis catus domesticus*, Linnaeus, 1758). Biosci J 21:189-195.

[34] Iglesias LP, Carneiro e Silva FO, Vasconcelos BG, Ribeiro LA, Hodniki NF, Gomes RL, Miglino MA, Melo APF (2012). Distribuição do nervo fibular comum em fetos de equinos e descrição anatômica de pontos para bloqueio anestésico. Pesqui Vet Bras 32: 672-676.

[35] Mariz MAS, Da Silva Neto JE, Soares JG (2001) A anatomia do nervo pudendo e seu bloqueio anestésico em caprinos. Ciência Animal 11:27-33.

[36] Chagas LGS, Drummond SS, Carneiro e Silva FO, Chagas RG (2010) Origem e distribuição do nervo retal caudal em suínos (*Sus scrofa domesticus*– Linnaeus, 1758) da linhagem Pen Ar Lan. Horizonte Cientifico 4:1-12.

[37] Brito TR, Vasconcelos BR, Iglesias LP, Santos AC, Viana DC, Carneiro e Silva FO (2014) Origem e distribuição do nervo retal caudal em equinos sem raça definida Biosci J 30: 1496-1501.

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

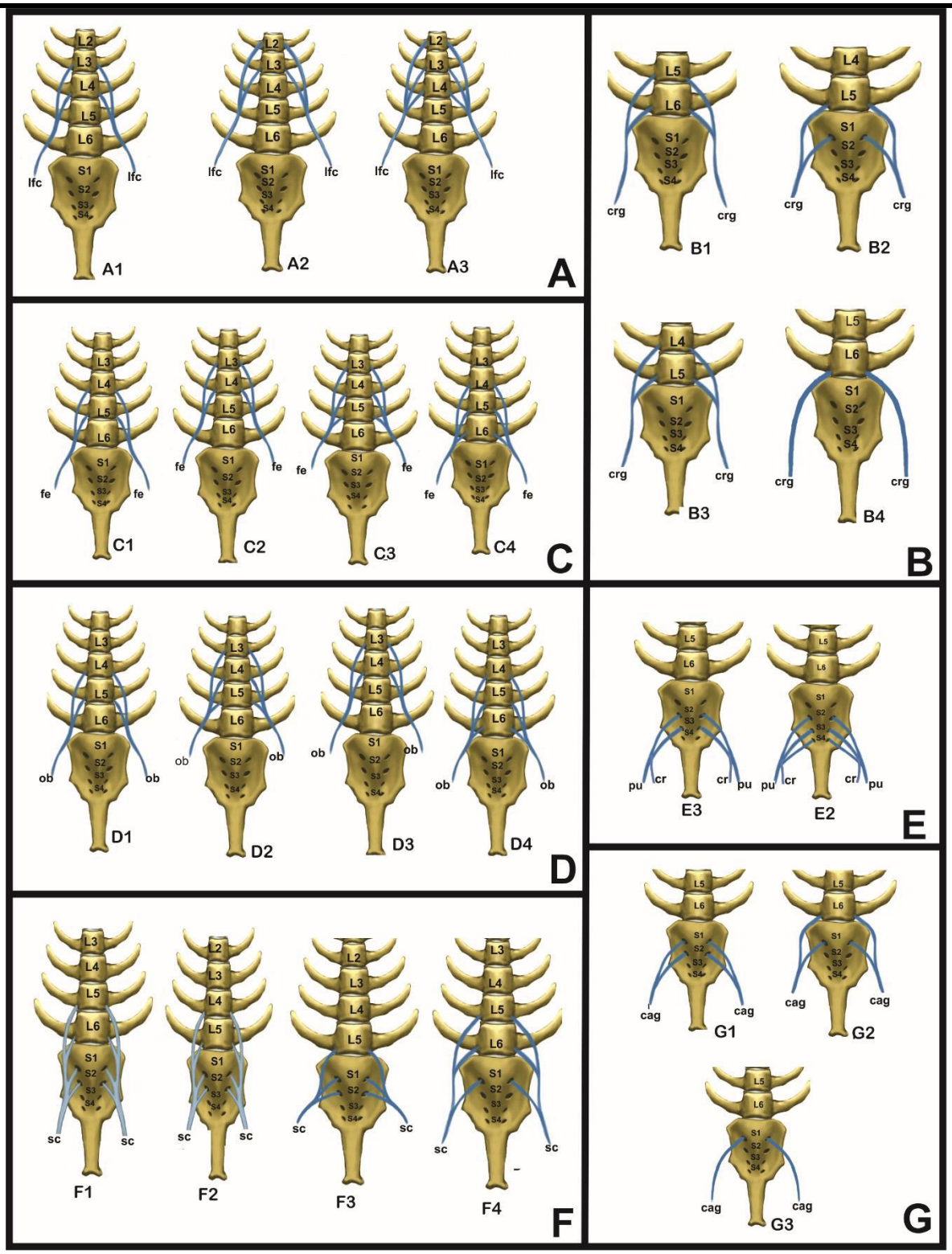

Fig. 1 Schematic drawing representing the lumbar and sacral regions and the variations of the origins of the component nerves of the lumbosacral plexus of Sus scrofa. (A) lfc, lateral femoral cutaneous nerve; A1, from L3 and L4; A2, from L2 and L3; A3, from L2, L3 and L4; (B) crg, cranial gluteal nerve; B1, from L5 and L6; B2, from L5 and S1; B3, from L4 and L5; B4, from L6; (C) fe, femoral nerve; C1, from L4 and L5; C2, from L3 and L4; C3, from L3, L4 and L5; C4, from L4, L5 and L6; (D) ob, obturator nerve, D1, from L4 and L5; D2, from L3, L4 and L5; D3, from L3 and L4; D4, from L4, L5 and L6; (E) pu, pudendal nerve; E1, from S2 and S3; E2, from S2, S3 and S4; (F) sc, sciatic nerve; F1, from L5, L6, S1 and S2; F2, from L4, L5, S1 and S2; F3, from L5, S1 and S2; F4, from L5, L6 and S1;(G)cag, caudal gluteal; G1, from S1 and S2; G2, from L6 and S1; G3 from S1. Nerves: cag, caudal gluteal nerve; crg, cranial gluteal nerve; fe, femoral nerve; lfc, lateral femoral cutaneous nerve; ob, obturator nerve; pu, pudendal nerve; sc, sciatic nerve.

https://dx.doi.org/10.22161/ijaers.6.3.8 ISSN: 2349-6495(P) | 2456-1908(O)

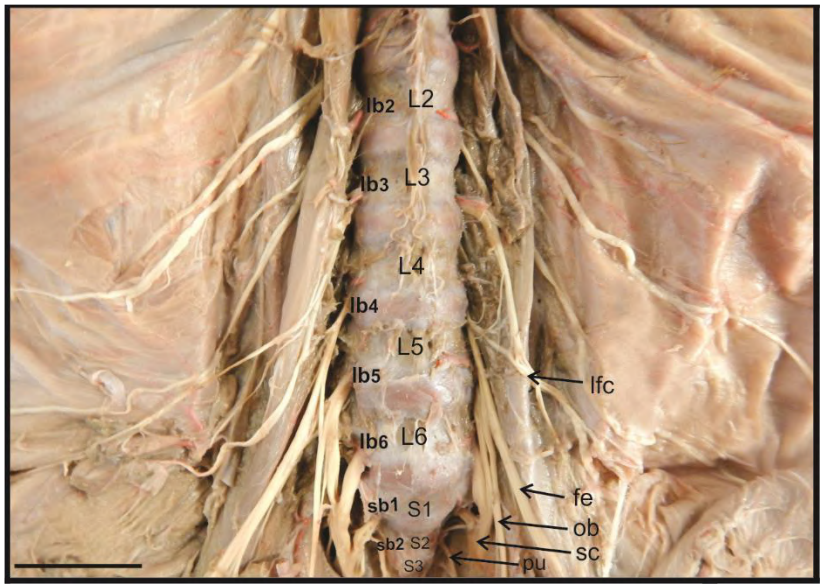

Fig. 2 Ventral view of the lumbar and sacral regions of Sus scrofa. L2-L6, second to sixth lumbar vertebrae; S1-S3, first to third sacral vertebrae; lb2 to lb6, second to sixth ventral branches of the lumbar spinal nerves; sb1 and sb2, first and second ventral branches of the sacral spinal nerves; Nerves: fe, femoral; lfc, lateral femoral cutaneous; ob, obturator; pu, pudendal; sc, sciatic. Scale bar 3 cm.

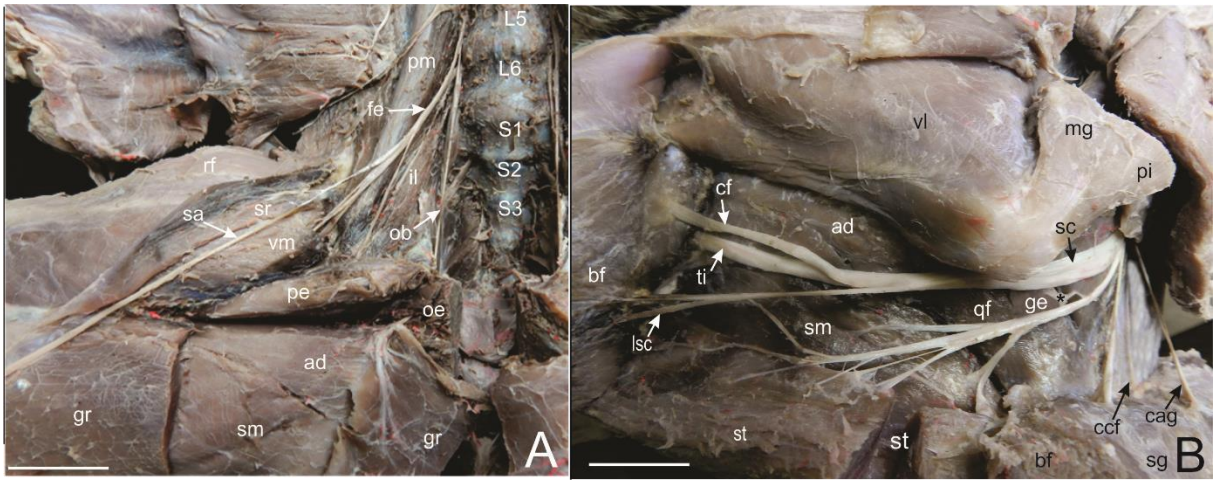

Fig. 3 (A)Ventral view of the lumbar and sacral regions of Sus scrofa.(B)Caudolateral view of the gluteal and thigh regions of the left antimere of Sus scrofa. L5 and L6, fifth and sixth lumbar vertebrae; S1-S3, first to third sacral vertebrae. Nerves: cag, caudal gluteal; ccf, caudal cutaneous femoral; cf, common fibular; fe, femoral; lsc, lateral sural cutaneous; ob, obturator; sa, saphenous; sc, sciatic; ti, tibial. Muscles:ad, adductor; bf, biceps femoris; ge, gemelli; gr, gracilis; il, iliacus; mg, middle gluteal; oe, obturator externos; pe, pectineus; pi, piriformis; pm, psoas major; qf, quadratus femoris; rf, rectus femoris; sa, sartorius; sg, superficial gluteal; sm, semimembranosus; st, semitendinosus; vl, vastus lateralis; vm, vastus medialis. (*) branches to gemelli and quadratus femoris muscles. Scale bar: 3 cm.

https://dx.doi.org/10.22161/ijaers.6.3.8 *ISSN: 2349-6495(P) | 2456-1908(O)*

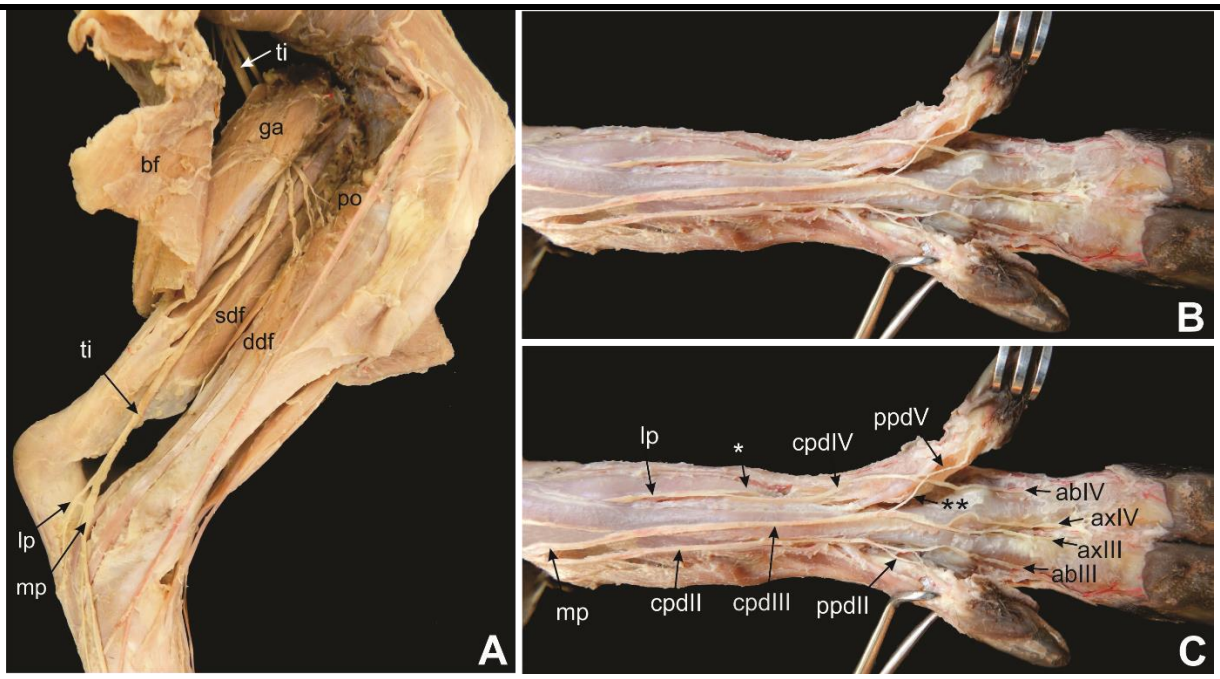

*Fig. 4 Pelvic limb of Sus scrofa. (A) Medial view of the left leg and tarsal joint. (B) and c Plantar view of right foot. Nerves: abIII, abaxial proper plantar digital III; abIV, abaxial proper plantar digital IV; axIII, axial proper plantar digital III; axIV, axial proper plantar digital IV; cpdII, common plantar digital II; cpdIII, common plantar digital III; cpdIV, common plantar digital IV; lp, lateral plantar; mp, medial plantar; ppdII, proper plantar digital II; ppdV, proper plantar digital V; ti, ti bial; * branches to the interosseous muscles; ** branch communicating with proper plantar digital nerve V. Muscles: bf, biceps femoris; ddf, deep digital flexor; ga, gastrocnemius; po, popliteus; sdf, superficial digital flexor. Scale bar 3cm.*

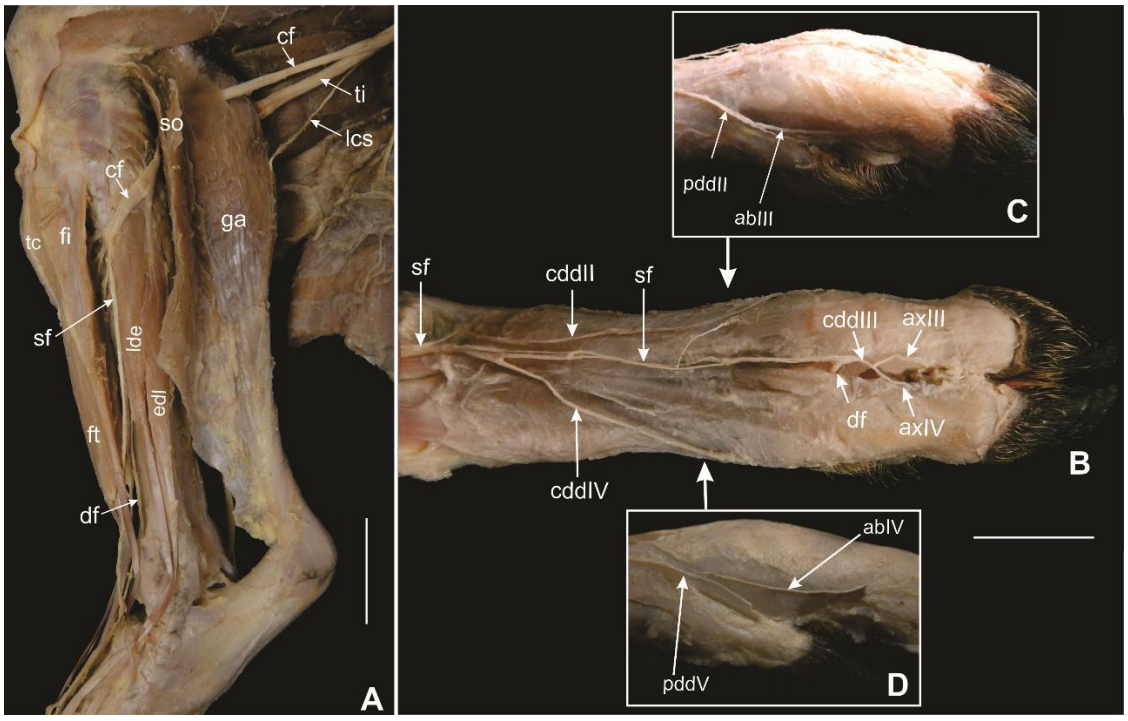

Fig. 5 Pelvic limb of Sus scrofa. (A)Lateral view of the left leg and tarsal joint. (B) Dorsal view of right foot. (C) Medial view of the metatarsophalangeal joint. (D) Lateral view of the metatarsophalangeal joint. Nerves: abpddIII, abaxial proper dorsal digital III; abpddIV, abaxial proper dorsal digital IV; axpddIII, axial proper dorsal digital III; axpddIV, axial proper dorsal digital IV; cddII, common dorsal digital II; cddIII, common dorsal digital III; cddIV, common dorsal digital IV; cf, common fibular; df, deep fibular; lcs, lateral cutaneous sural; pddII, proper dorsal digital II; ppdV, proper dorsal digital V; sf, superficial fibular; ti, tibial. Muscles: edl, extensor digitorum longus; fl,

https://dx.doi.org/10.22161/ijaers.6.3.8 ISSN: 2349-6495(P) | 2456-1908(O)

fibularis longus; ft, fibularis tertius; ga, gastrocnemius; lde, lateral digital extensor; so, soleus; tc, tibialis cranialis. Scale bar 3 cm.

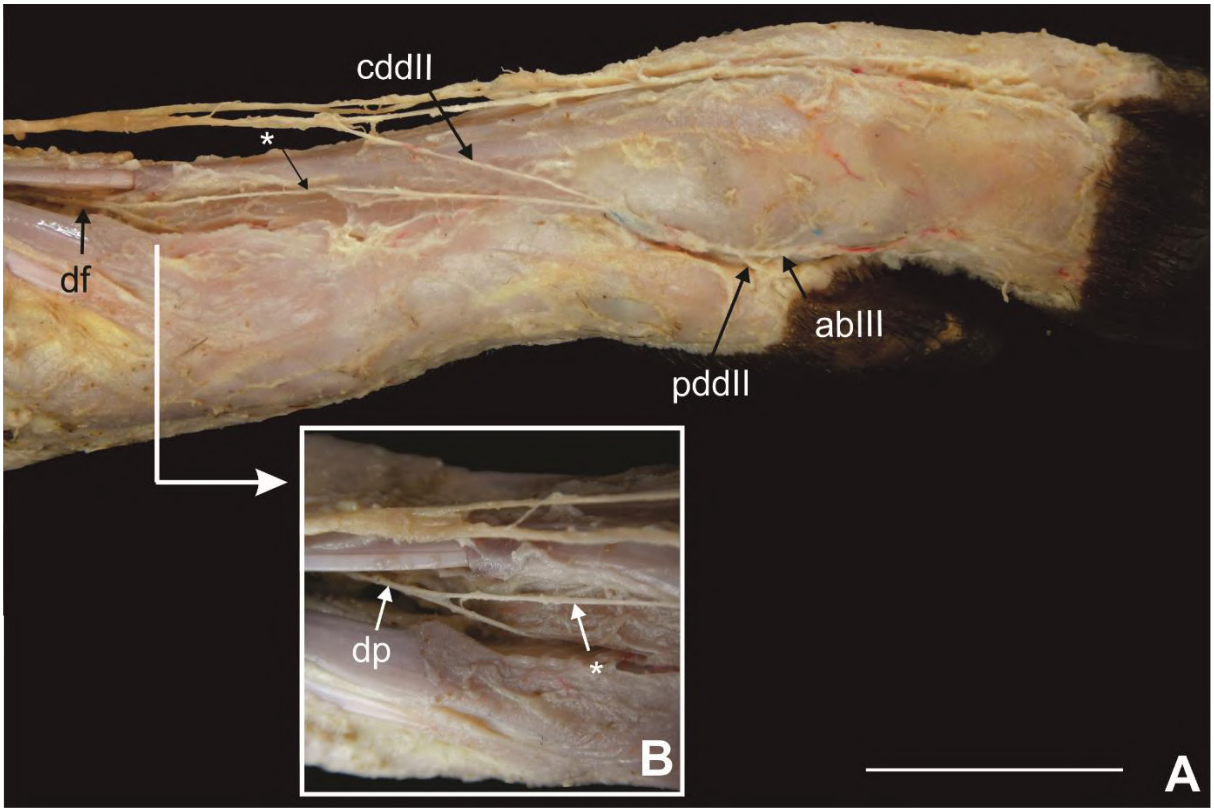

*Fig. 6 Left foot of Sus scrofa. (A) Dorsomedial view. (B) Extended view of the metatarsal region. Nerves: abpddIII, abaxial proper dorsal digital III; cddII, common dorsal digital II; df, deep fibular; pddII, proper dorsal digital II; * branch communicating with common dorsal digital nerve II. Scale bar 3 cm.*

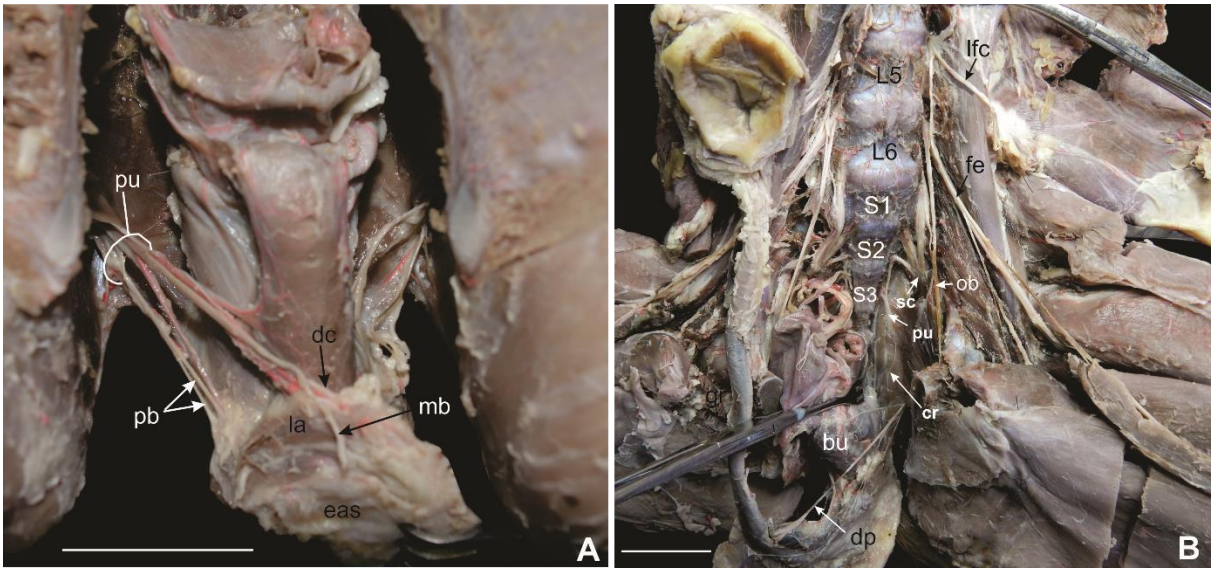

Fig. 7 Ventral view of pelvic cavity of Sus scrofa. (A) female and(B) male. L2 and L6, second and sixth lumbar vertebrae; S1-S3, first to third sacral vertebrae. Nerves: cr, caudal rectal; dc, dorsal nerve of clitoris; dp, dorsal nerve of the penis; fe, femoral; lfc, lateral femoral cutaneous; mb, mammary branches; ob, obturator;pb, perineal branches; pu, pudendal; sc, sciatic. Muscles: bu, bulbospongiosus; eas, external anal sphincter; la, levator ani. Scale bar 3cm.