P-ISSN: 2304-3075; E-ISSN: 2305-4360
International Journal of Veterinary Science
www.ijvets.com; editor@ijvets.com

Research Article

Comparative Anatomical and Radiographic Variations of Celiac Trunk in Guinea pig *(Cavia porcellus)* and White rat *(Rattus norvegicus)*

Maher MA and Reem RT

Anatomy and Embryology Department, Faculty of Veterinary Medicine, Cairo University, Egypt
***Corresponding author:** dr.maher85@yahoo.com

Article History: Received: June 15, 2018 Revised: June 30, 2018 Accepted: August 12, 2018

ABSTRACT

The current investigation was carried out on 10 guinea pigs and 10 white rats, 5 males and 5 females of each, weighing 420 g for guinea pigs and 280 g for white rats on average. All the animals used were already submitted to euthanasia. The radiographic technique using red lead oxide and filling the arterial system with 60% gum milk latex colored red with Rotring® ink was applied. The animals used revealed an obvious variability in the celiac artery origin, distribution, course and number of branching pattern. Our study aimed to help in solving the surgical therapeutic techniques in abdominal cavity. This vasculature study in guinea pigs and white rats is very important for human researcher to help them to apply different experimental techniques of ischemia and the organ transplantations. The guinea pig did not have separate celiac and cranial mesenteric arteries but these two vessels originated as a single trunk from the abdominal aorta which known as "celiacomesenteric trunk" in addition to the presence of a short common trunk for the splenic and left gastric arteries. While in rats, the celiac trunk was found to be separated from the cranial mesenteric artery and being clearly trifurcated with the absence of cystic artery.

Key words: Celiaco-mesenteric trunk, Gastrosplenic artery, Radiographic study, Guinea pig and White rat.

INTRODUCTION

Among the visceral branches of the abdominal aorta, the celiac artery has a great relevance in the clinical anatomy, surgery and angiographic procedures, as it is responsible for the blood supply to important viscera such as stomach, liver, spleen, pancreas and portion of the intestine (Nayar *et al.*, 1983). This vessel emerged from the ventral aspect of the abdominal aorta in its most cranial portion. Generally, the celiac artery originates soon after the passage of descending aorta through the aortic hiatus of the diaphragm, while the cranial mesenteric artery is caudally in relation to the former, few millimeters away (Dyce *et al.*, 1997; Schaller, 1999 and König and Liebich, 2004).

Several authors have studied the celiac artery distribution in different domestic animals (Machado *et al.*, 2000) in buffaloes, (Niza *et al.*, 2003) in dogs and (Abidu-Figueiredo *et al.*, 2005, 2008) in dogs and rabbits respectively; demonstrating that their arrangement and ramification are very variable and that accurate knowledge of this variability is of great importance in practical and theoretical study in these experimental laboratory animal models.

Numerous studies on differences in vascularization between different animals demonstrated that the celiac and cranial mesenteric arteries were separated from each other. However, some authors had reported cases in which both arteries had their origin in a single branch called celiaco-mesenteric trunk (Machado *et al.*, 2000) in buffaloes, (Ferreira *et al.*, 2001) in goats, (Schmidt and Schoenau, 2007) in dogs and (Çavdar *et al.*, 1997 and Çiçekcibasi AE *et al.*, 2005) in humans.

From the clinical point of view, the most available and best practical example of small laboratory animals being used, were the guinea pigs and white rats which act as an excellent animal model for biochemical, pharmaceutical, anatomo-surgical, veterinary and human researches. However, the low cost, availability, small size and easy handling during practice, made them the best choice for documentation of anatomical differences.

The aim of this study was to compare anatomically and radiographically the distributional variations of the celiac trunk in the domesticated laboratory guinea pig and white rat.

Cite This Article as: Maher MA and RT Reem, 2018. Comparative anatomical and radiographic variations of celiac trunk in guinea pig *(Cavia porcellus)* and white rat *(Rattus norvegicus)*. Inter J Vet Sci, 7(3): 145-152. www.ijvets.com
(©2018 IJVS. All rights reserved)

MATERIALS AND METHODS

The current anatomical investigation was performed on 10 guinea pigs and 10 white rats, 5 males and 5 females of each, weighing 420 g for guinea pigs and 280 g for white rats on average and with a mean facial-sacral length of 16.84 cm for guinea pigs and 12.52 cm for white rats. All the animals used were already submitted to euthanasia using light inhalation of chloroform. The animals used were positioned in the right lateral position and then the chest was opened from the left side and dissected to reveal the thoracic portion of the aorta, which was cannulated using a flexible plastic butterfly of approximately 0.1 cm in diameter and 5 cm length. Thus, the arterial system was washed with 0.9% NaCl solution, followed by fixation with 10% formaldehyde solution according to the standard anatomical technique. The vessels were then filled with 60% gum milk latex colored red with Rotring® ink and one animal was used for radiography using red lead oxide mixed with latex. The animals were kept in jars with 10% formaldehyde solution for 3 days for latex polymerization. With the aid of a vernier caliper, the length, diameter of abdominal aorta, celiaco-mesenteric and celiac trunks were measured. The celiac artery branches were radiographed, dissected and photographed using a digital photo camera Nikon Coolpix L310 14.1 Megapixels in 9 photos. The nomenclature used was that recommended by the Nomina Anatomica Veterinaria, 5th edition by (Frewein and Habel, 2012) as well as the previous literatures.

RESULTS

Abdominal aorta (*Aorta Abdominalis*)

The abdominal aorta (Fig. 1, 2, 9/1) was the direct arterial continuation of the large initial part of descending aorta, known as the thoracic aorta after being emerged from the diaphragm through its aortic hiatus (Fig. 2/O) and extended caudally till its terminal division or bifurcation to right and left common iliac arteries. It was topographically located throughout its course within a ventral median groove filled with fats in the hypoaxial sublumbar muscles and measured an average length/diameter of about 6.4/0.221 cm in guinea pig and 4.2/0.124 cm in rat, and closely related along its length and from the right aspect by the caudal vena cava. It gave many branches but we concerned here with only a large main trunk, the celiac artery and demonstrated its anatomical association with the cranial mesenteric artery.

Celiac Artery (*A. Celiaca*)

The celiac artery (Fig. 2, 4, 9/2) was the first main single trunk emerging from the ventral aspect of the abdominal aorta after its passage from the aortic hiatus of the diaphragm.

In guinea pigs, we observed that all the dissected animals were found to be not having separate celiac and cranial mesenteric (Fig. 1, 5/3) arteries but having these two vessels originated as a single trunk from the abdominal aorta which was known as "Celiaco-mesenteric trunk"(Fig. 1, 3/4). This later trunk was the first branch emerging from the abdominal aorta caudal to the diaphragm by about 0.7 cm and directed ventrally and perpendicular to the long axis of the aorta and after a distance of about 1 cm, giving two large arteries separated by about 0.3 cm in between. The first was a common trunk for the splenic artery (Fig. 3, 5/6) and the left gastric artery (Fig. 3, 5/10) while the second for the common hepatic artery (Fig. 1, 3, 7/14). Then the celiaco-mesenteric trunk continued as a cranial mesenteric artery after the origin of the common hepatic artery.

While in rats, it found to be clearly observed in all dissected animals that the first branch emerging from the abdominal aorta was the caudal phrenic artery (Fig. 2/25) which supplying the crura of the diaphragm (Fig. 2/m,n) and the other main difference was that the celiac artery (Fig. 2/2) is a single trunk, trifurcated into three main separate arteries and found to be separated from the caudoventrally directed cranial mesenteric artery (Fig. 2/3) by a mean distance of 1.5 cm in length.

Branches of celiac artery

The celiac artery has a great role in the irrigation and nourishing of important digestive organs as the spleen, stomach, liver, pancreas and the initial portion of the duodenum. There was some variability between guinea pig and rat which may be in the origin, distribution, course or even the number of subdivision but the main celiac artery divisions are anatomically constant and identified as the splenic, left gastric and common hepatic arteries:

The Splenic Artery (*A. Lienalis*)

Guinea pigs: The splenic artery (Fig. 3, 5/6) was found to be originated together with the left gastric artery (Fig. 3, 5/10) by a single short common trunk called gastrosplenic artery (Fig. 1, 3, 5, 7/5) which emerged opposite to the common hepatic artery (Fig. 1, 3, 5, 7/14) from the celiaco-mesenteric trunk (Fig.7/4) after a distance of 1.5 cm from the abdominal aorta (Fig.7/1). The splenic artery directed toward the left side of stomach body and splenic hilus in the gastrosplenic ligament giving rise to three main splenic branches (Fig. 3/7) but with a unique distribution.

The first and second splenic branches originated by a very short common trunk then directed toward the spleen and ventrally, the first splenic branch giving two small twigs supplying the proximal end of the spleen but did not give a short gastric branch to stomach. The second splenic branch descending parallel to the third branch and at the level of splenic mid-point, being subdivided into two smaller branches, one entering the middle of splenic hilus and the other is a short gastric artery that supplying the greater curvature of stomach body.

The third splenic branch seems to be considered as the continuation of splenic artery coursing ventrally in parallel with the second branch and at the distal end of the spleen, being subdivided into two branches, one directing into the distal splenic hilus and the other one further divided into another two branches, one of them entering the greater omentum which called epiploic branch (Fig. 3/24) and the other one distributed in the distal convex part of the stomach greater curvature which called the left gastroepiploic artery (Fig. 3/9). It was clearly observed that the splenic artery and its branches except the first splenic branch, all participating in nourishing the pancreas and left part of stomach through small pancreatic branches (Fig. 3/23) and short gastric (Fig. 3, 7/8) arteries respectively.

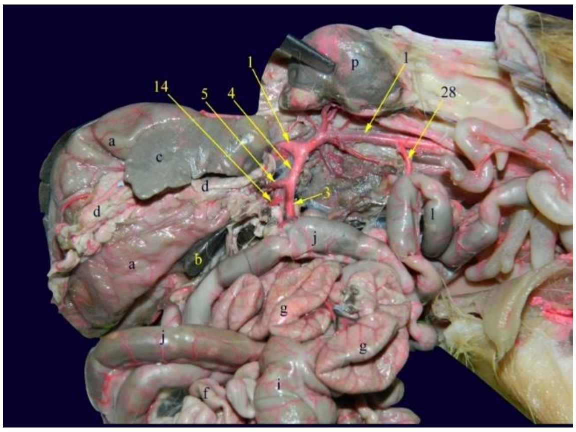

Fig. 1: Gross anatomical photograph of guinea pig abdomino-pelvic cavity showing the origin and course of celiaco-mesenteric trunk.

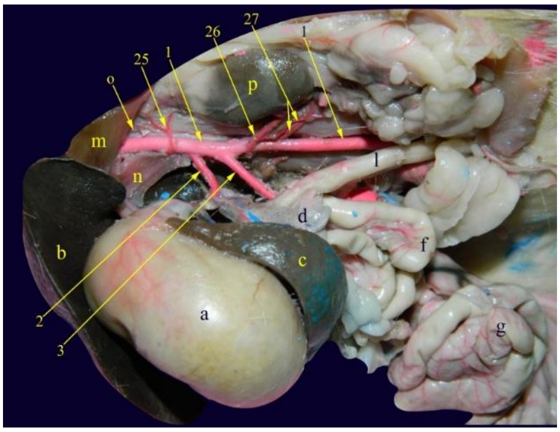

Fig. 2: Gross anatomical photograph of rat abdomino-pelvic cavity showing the origin of celiac trunk.

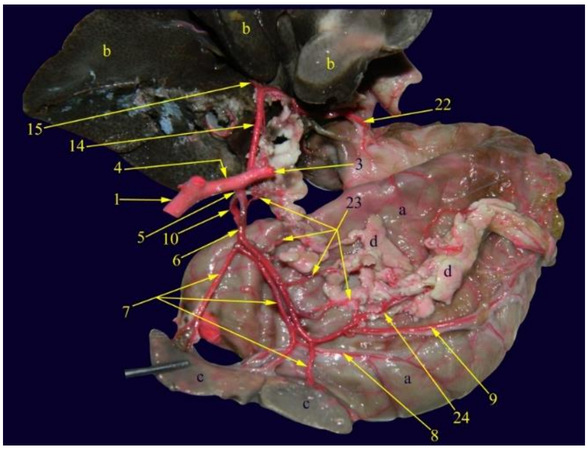

Fig. 3: Gross anatomical photograph of guinea pig stomach, liver, spleen and pancreas showing the distribution of the splenic artery.

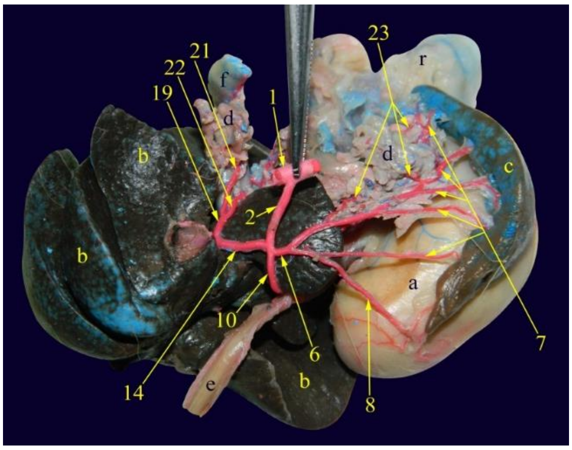

Fig. 4: Gross anatomical photograph of rat stomach, liver, spleen and pancreas showing the distribution of the splenic artery.

Rats: The splenic artery (Fig. 4, 6, 8/6) was a single second branch of the celiac artery originated at a point little distal to the origin of the common hepatic artery (Fig.4,6,8/14) and on the opposite side. The splenic artery directed toward the left side being perpendicular on the celiac artery (Fig. 4/2) and coursing in the gastrosplenic ligament and giving rise to 5-8 splenic branches (Fig. 4/7).

The first splenic branch forming a common trunk which divided early into two branches, the proximal one is the short gastric artery (Fig. 4/8) supplying the fundus and upper part of the stomach greater curvature while the distal one (Fig. 4/7) entering the proximal splenic hilus to supply the splenic parenchyma.

The remaining splenic branches (Fig. 4/7) may be divided or not up on reaching the splenic hilus but were found evenly distributed at constant intervals ending into the splenic hilus and participating by small pancreatic branches (Fig. 4/23) and short gastric arteries. The last splenic branch was found to give rise to two separated branches, one entering the greater omentum called the epiploic branch (Fig.8/24) and the other branch coursing around the stomach greater curvature which called the left gastroepiploic artery (Fig. 8/9).

The Left Gastric Artery (*A. Gastrica Sinistra*)

Guinea pigs: The left gastric artery (Fig. 5/10) observed to be originated by a short trunk in common with the previously mentioned splenic artery. It is the main arterial blood supply to the body of the stomach which divided after 2 cm from its point of separation from the splenic division into two branches directed toward the stomach lesser curvature to supply the visceral and parietal surfaces of the stomach through visceral (Fig. 5/11) and parietal (Fig. 5/12) branches respectively. The visceral branch was seen to be divided earlier than the parietal one. It was divided into 3-4 smaller branches circling and nourishing the cardia, fundus, visceral surface and the left upper part of the stomach and sending small twigs to the oesophagus (Fig. 5/13).

The parietal branch of left gastric artery continued toward the middle part of lesser curvature where it divided into only two smaller branches, one of them being restricted to the region of the lesser curvature while the other branch distributed on the parietal surface of the stomach after giving small fine twigs to the pylorus to communicate with the fine branches (Fig. 5/28) of the gastroduodenal artery; an artery originating from the common hepatic artery.

Rats: The celiac artery appeared to be trifurcated taking a specific pattern in which, two opposite arteries, the splenic (Fig. 4/6) and the common hepatic (Fig. 4/14) arteries while the left gastric artery (Fig.4/10) is the third division seems to be the direct ventral continuation of the celiac trunk (Fig. 4/2). The left gastric artery beginning straight toward the lesser curvature parallel and mostly right to the abdominal part of oesophagus and after a distance of 4 cm, it was divided into two short visceral (Fig. 8/11) and parietal (Fig. 6/12) branches. The visceral branch was further divided into 2 smaller branches each of them giving 4-5 smaller twigs distributed in a radiating manner through the serosa of the stomach visceral surface.

The parietal branch of left gastric artery directed cranially toward the parietal surface of the stomach and gave a small oesophageal branch (Fig.6/13) at the point of its origin then continue to be further divided into 3 branches each giving 2-3 smaller twigs to supply the parietal surface of stomach body.

It was clearly noticed that the left gastric artery was highly extra-gastric branched giving more twigs in rats than in guinea pigs and its visceral and parietal branches were mostly located toward the right half of the stomach in case of rats (Fig.6) than in guinea pigs (Fig. 5) where their distribution was even to all parts of the stomach. In addition, another difference was that the oesophageal branch being originated from the parietal branch of left gastric artery in case of rats (Fig.6/13) while from the visceral one in case of guinea pigs (fig.5/13).

The Common Hepatic Artery (*A. Hepatica Communis*)

Guinea pigs: The common hepatic artery (Fig. 7/14) was the second artery found to be originated few millimeters below the origin of the gastrosplenic trunk (Fig. 5, 7/5) and being opposite to the later trunk. Otherwise, it was emerged from the celiaco-mesenteric trunk (Fig. 7/4) and continued cranially toward the liver for about 3 cm till reaching the dorsal border of liver. At this point, and before turning toward the opposite gastric side, giving rise to the hepatic artery (Fig. 7/15) which coursing in the portal fissure of liver in between the caudate and papillary lobes where it divided into right (Fig. 7/16) and left hepatic (Fig. 7/17) branches. However, the left hepatic branch giving rises to an artery supplying the cystic duct and gall bladder which called a cystic artery (Fig. 7/18).

The common hepatic artery being continued as a gastroduodenal artery (Fig. 7/19) after giving rises to the hepatic artery. This gastroduodenal artery coursing toward the right part of stomach and duodenum considered as the direct continuation of the common hepatic artery. The gastroduodenal artery after about 1.5 cm, giving descending small branches to the pylorus called pyloric arteries (Fig. 7/20) (two in number) toward the gastric side and fine pancreatic branches (Fig. 7/23) toward the

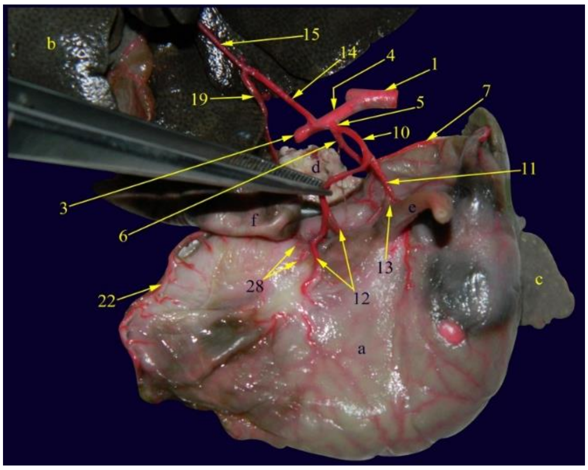

Fig. 5: Gross anatomical photograph of guinea pig stomach, liver, spleen and pancreas showing the distribution of the left gastric artery.

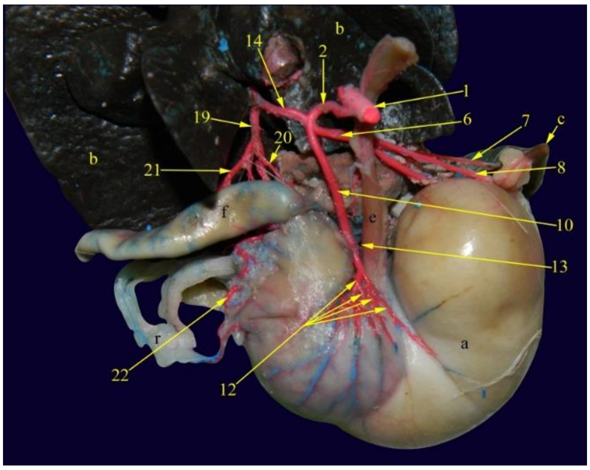

Fig. 6: Gross anatomical photograph of rat stomach, liver, spleen and pancreas showing the distribution of the left gastric artery.

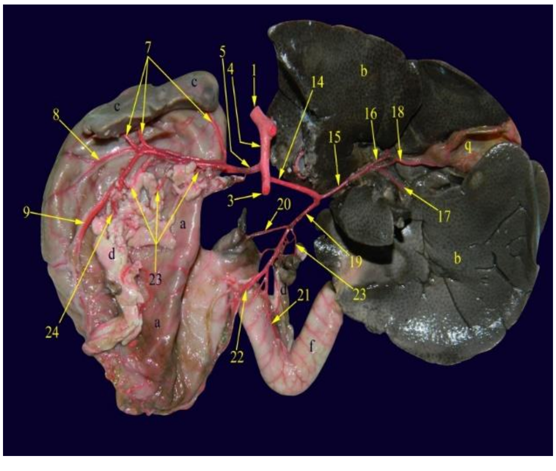

Fig. 7: Gross anatomical photograph of guinea pig stomach, liver, spleen and pancreas showing the distribution of the common hepatic artery.

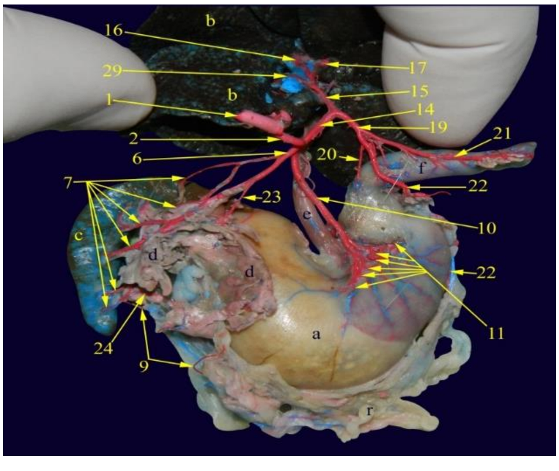

Fig. 8: Gross anatomical photograph of rat stomach, liver, spleen and pancreas showing the distribution of the common hepatic artery.

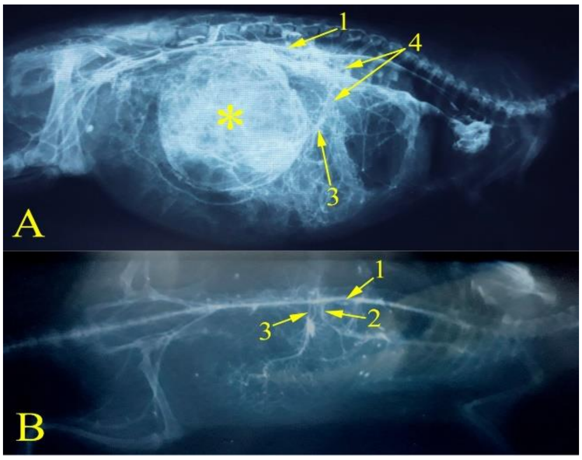

Fig. 9: Radiographic figure showing the origin of celiac, celiaco-mesenteric and cranial mesenteric arteries in guinea pig (A) and rat (B). (*) Gravid uterus of guinea pig.

Legends of Figures

1.	Abdominal aorta.	a.	Stomach.
2.	Celiac artery.	b.	Liver.
3.	Cranial mesenteric artery.	c.	Spleen.
4.	Celiaco-mesenteric trunk.	d.	Pancreas.
5.	Gastro-splenic artery.	e.	Oesophagus.
6.	Splenic artery.	f.	Duodenum.
7.	Splenic branches.	g.	Jejunum.
8.	Short gastric branches.	h.	Ileum.
9.	Left gastro-epiploic artery.	i.	Cecum.
10.	Left gastric artery.	j.	Ascending colon.
11.	Visceral branches of 10.	k.	Transverse colon.
12.	Parietal branches of 10.	l.	Descending colon.
13.	Oesophageal branch.	m.	Left crus of diaphragm.
14.	Common hepatic artery.	n.	Right crus of diaphragm.
15.	Hepatic artery.	o.	Aortic hiatus.
16.	Right hepatic artery.	p.	Left kidney.
17.	Left hepatic artery.	q.	Gall bladder (Guinea pig only).
18.	Cystic artery (Guinea pig only).	r.	Greater omentum.
19.	Gastro-duodenal artery.		
20.	Pyloric artery.		
21.	Cranial pancreatico-duodenal artery.		
22.	Right gastro-epiploic artery.		
23.	Pancreatic branches.		
24.	Omental (epiploic) branches.		
25.	Caudal phrenic artery.		
26.	Renal artery.		
27.	Lumbar arteries.		
28.	Anastomotic branch with gastroduodenal artery.		
29.	Caudate lobe artery		

duodenal side then divided up on reaching the initial part of descending duodenum into cranial pancreaticoduodenal artery (Fig. 7/21) irrigating the descending duodenum and the right lobe of pancreas and continued till anastomosed with the caudal pancreaticoduodenal artery from the cranial mesenteric artery and the right gastroepiploic artery (Fig. 7/2) which coursing on the greater curvature of stomach giving fine twigs toward the stomach and others toward the greater omentum (epiploic branches) till reaching the middle of the greater curvature where it is anastomosed with the left gastroepiploic artery of the splenic artery.

Rats: The common hepatic artery in rats was closely similar to that of the guinea pigs in its distribution and course but there was a little clear variability between them.

The variability observed was that the common hepatic artery in rats (Fig. 8/14) was the first artery originated opposite to and little above the origin of the splenic artery (Fig. 8/6) from the celiac trunk (Fig. 8/2) after a distance of 3 cm from the abdominal aorta and found to be little shorter than of guinea pigs.

The next main difference was that the hepatic artery before dividing into right and left hepatic branches giving a clear caudate lobe artery (Fig. 8/29) and there was no a cystic artery due to absence of the gall bladder and cystic duct in white rats.

The last different point observed was the presence of single pyloric artery (Fig. 8/20) which originated her from the right gastroepiploic artery (Fig. 8/22) instead of the gastroduodenal one.

DISCUSSION

The current study revealed that the celiac artery found in common trunk called "celiaco-mesenteric" trunk with the cranial mesenteric artery at a level of second lumbar vertebra in guinea pigs but was found separated from the cranial mesenteric artery with a mean length of 0.5-1 cm and preceded by a caudal phrenic artery in all dissected rats. While Abidu-Figueiredo *et al* (2008) asserted that the celiac artery of rabbit, the first major ventral branch of the abdominal aorta, arose as an only one artery in all dissected rabbits arising between the 12th and 13th thoracic vertebra in 36.7% of animals; between the 13th thoracic vertebra and the 1st lumbar vertebra in 40% of animals; at the level of the 13th thoracic vertebra in 20% of animals; and at the level of the 1st lumbar vertebra in only 3.3% of animal with a mean length of the celiac artery was 0.5cm.

Berg (1961) in 41% of cats, Abidu-Figueiredo (2005) in dogs and Ahasan *et al* (2012) in rabbits, all had observed that the celiac artery was divided into common trunk for hepatic, gastroduodenal and right gastric arteries and common trunk for splenic and left gastric arteries. A result which was similar to our observations in guinea pigs except for the presence of right gastric artery which was neither present in guinea pigs nor in rats.

Our investigations in the present study of guinea pigs was greatly different with (Abidu-Figueiredo *et al.*, 2008 and Nowicki *et al.*, 2010) who reported that, in all dissected rabbits the first branch of the celiac artery was the splenic artery, the second branch was the left gastric artery and the hepatic artery arose from the left gastric artery. While these observations were completely similar to that observed by (McLaughlin and Chiasson, 1979 and Ahasan *et al.*, 2012) in rabbits, that the celiac artery divisions were concluded into two common trunks, the first for the splenic and left gastric arteries and the second for the common hepatic and gastroduodenal arteries.

Our results were unlike that reported by (Tsuzaki, 1935, Barone *et al.*, 1973, Popesko *et al.*, 2002, Abidu-Figueiredo *et al.*, 2008 and Ikegami *et al.*, 2016) in rabbits that the splenic artery arose as the first independent branch of the celiac artery in all animals examined and preceded to the left toward the splenic hilus that runs along the visceral surface of the spleen. Upon reaching the hilus, it gave off different branches to the spleen and others to the stomach.

In rodents, which are very close in habits and behavior to the lagomorph, the origin of the splenic artery was variable in each species. In the guinea pig, the splenic artery usually arises as a common trunk with the left gastric artery called gastrosplenic artery (Shively and Stump, 1975 and Bednářová and Malinovský, 1990). Whereas in the rat (Hebel and Stromberg, 1986), dormouse (Ventura and López-Fuster, 1994) and Mediterranean pine vole (Ventura *et al*., 1995), the splenic artery usually arises as one of the trifurcated branches of the celiac artery. A result which was simulates our observations.

Our investigations in rats were similar to that found by (Bivin *et al*., 1987) in the hamster, (Bisaillon *et al*., 1988) in muskrat, (López-Fuster and Ventura, 1992) in wood mouse and (Ventura *et al*., 1996) in degu that the splenic artery usually arises as an independent branch of the celiac artery or as the second independent branch in the North American beaver (Bisaillon and Bhérer, 1979). However, Bednářová and Malinovský (1988) in rabbit confirmed that not the splenic artery but the hepatic artery was the first branch in 1 out of 30 cases that they examined.

Ikegami *et al* (2016) had revealed that each splenic branch of rabbit arose as either an independent branch of the splenic artery or as a trunk in common with a short gastric artery. They also added that the first branch of the splenic artery was always a short gastric artery or the common trunk of a splenic branch with a short gastric artery, but never a splenic branch. A result which was in accordance with our findings in rats only but never been observed in guinea pigs in which the first branch of splenic artery was for the spleen only.

Our observations were disagreed with the results reported by (Özdemir *et al*., 2013) in chinchilla that there was one trunk, which called the gastrosplenic artery, supplying the dorsal spleen and the greater curvature of the stomach and the other, which called the splenic artery, supplying the central and the ventral spleen and originated from the celiac artery at the same level. They also added that it was considered that these two trunks in the chinchilla might correspond to one common trunk of the splenic artery with the left gastric artery in the rabbit.

The number of the splenic branches varied from 3 to 10 according to the specimen. Furthermore, the number of the common trunk (s) of the splenic branches with short gastric arteries varied from 0 to 4 (Ikegami *et al*., 2016) in rabbits. While Abidu-Figueiredo *et al* (2008) studied 30 New Zealand rabbits (weight, 2.5 kg) and obtained different results in that the number of the splenic branches varies from 1 to 5 with 3 branches (33.3%) being the most frequent. In the rat, whose spleen is shaped similar to that of the rabbit (Hebel and Stromberg, 1986 and Vdoviaková *et al*, 2015), it is reported that the number of splenic branches was 5 to 8. This finding is similar to that from our study, wherein all of the rats have 5 to 8 splenic branches.

Vdoviaková *et al* (2015) had reported generally that the splenic artery in rats continued as the left gastroepiploic artery on the greater curvature of the stomach. This left gastroepiploic artery was divided into short gastric arteries, which supplied the fundic region of the greater curvature of the stomach. These short gastric arteries were visible on gastric surfaces. But our observations and those of (Shively and Stump, 1975) in guinea pigs and (Mohamed, 2014) in rabbits confirmed that the continuation of splenic artery ended by the epiploic branch to the greater omentum and left gastroepiploic artery to the stomach greater curvature.

Nickel *et al* (1983) and Nielson (1995) had reported that the left gastric artery arose directly from the splenic artery in cats, dogs and pigs. While (Schwarze, 1970 and Abidu-Figueiredo, 2005) confirmed that the left gastric artery arose directly from the celiac artery in horses and bovines, and directly from the hepatic artery in ovine.

Our investigations were in agreement with that found by (Vdoviaková *et al*, 2015) in rats that the left gastric artery originated directly from the celiac artery in all cases. The left gastric artery directed on the lesser curvature of the stomach in the region of the insertion of the gastric mesentery (mesogastrium). Along this course it gave off the parietal and visceral branches to the surfaces of the stomach. But we noticed that the left gastric artery was mostly located to the right gastric part in rats than in guinea pigs.

Our observations of guinea pig hepatic artery were similar to be found by (Ahasan *et al*., 2012) in New Zealand white rabbit who reported that the hepatic artery arose by a common trunk with gastroduodenal artery from the celiac artery. The hepatic artery proceeded on the visceral surface of the liver toward the porta hepatis where it ramified. While (McLaughlin and Chiasson, 1979 and Abidu-Figueiredo *et al*., 2008) had recorded that the hepatic artery was a branch of the left gastric artery or it was the continuation of the left gastric artery in New Zealand rabbits.

We are completely disagreed with (Mohamed, 2014) in rabbits who observed that the gastroduodenal artery arose from the cranial mesenteric artery. It arose at the same origin of the caudal pancreaticoduodenal artery of the cranial mesenteric artery. But greatly agreed with him in that the right gastroepiploic artery gave gastric branches to the greater curvature of the pyloric region of the stomach and fine epiploic branches to the greater omentum and it anastomosed with the left gastroepiploic artery of the splenic artery in both the guinea pigs and rats.

Our results were not similar to that reported by (Ahasan *et al*., 2012 and Mohamed, 2014) in New Zealand white rabbit and (Vdoviaková *et al*., 2015) in rats that the right gastric artery arose in a common trunk with hepatic and gastroduodenal arteries from the celiac artery. They also observed that the right gastric artery coursed caudoventrally towards the lesser curvature of the stomach and detaching a pyloric branch which descended on the lesser curvature of the stomach and the pyloric antrum and it gave a twig to the body of the stomach then terminated by two branches on the parietal surfaces of the stomach. A result which not simulates our findings where the right gastric artery was absent in both guinea pigs and rats which compensated by the pyloric branches of gastroduodenal artery.

Conclusion

The present investigation illustrated a clear variability between two species of rodents, the guinea pigs and white rats in the origin, branching pattern and distribution of the celiac artery. These variations are of a great importance in the surgical experiments as for introducing of micro-catheters for emboli. The presence of "celiaco-mesenteric trunk" and the common trunk for the splenic and left gastric arteries in the guinea pigs was a clear difference. The trifurcation of celiac trunk and separation of celiac from cranial mesenteric artery in rats and the absence of right gastric artery in both studied animals, all these observations had been confirmed through radiographic technique.

REFERENCES

Abidu-Figueiredo M, B Xavier-Siva, TM Cardinot, MA Babinski and MA Chagas, 2008. Celiac artery in New Zealand rabbit: anatomical study of its origin and arrangement for experimental research and surgical practice. Pesqui Vet Bras, 28: 237–240.

Abidu-Figueiredo M, GP Dias, S Cerutti, B Carvalho-De-Souza, RS Maia and MA Babinski, 2005. Variations of celiac artery in dog: anatomical study for experimental, surgical and radiological practice. Int J Morph 23: 37- 42.

Ahasan ASML, MS Islam, ASMG Kibria, ML Rahman, MM Hassan and M Uddin, 2012. Major Variation in Branches of the Abdominal Aorta in New Zealand White Rabbit (Orycotolagus Cuniculus). Int J Nat Sci, 2: 91- 98.

Barone R, C Pavaux, PC Blin and P Cuq, 1973. Atlas d'Anatomie du Lapin (translated into Japanese by Mochizuki, K.), Gakusosha, Tokyo.

Bednářová Z and L Malinovský, 1990. Variability of branching of the a. coeliaca (truncus coeliacomesentericus) in the guinea pig (*Cavia aperea f. porcellus*). *Folia Morphol. (Praha)* 38: 382–395.

Bednářová Z and L Malinovský, 1988. Ramification of the coeliac artery in the domestic rabbit (Oryctolagus cuniculus f. domestica). Scr. Med. (Brno) 61: 17–34.

Berg R. 1961. Comprehensive research on the course of the aorta branches in Felis domestica. Anat Anz. 110: 224–250.

Bisaillon A, A Grenier and R Bousquet, 1988. Arterial blood supply to the stomach of the muskrat (*Ondatra zibethicus*). *Anat. Histol. Embryol.* 17: 7–11.

Bisaillon A and J Bhérer, 1979. Gross anatomy of the arterial supply of the stomach of the North American beaver *(Castor canadensis)*. Acta Anat (Basel), 104: 79–85.

Bivin WS, GA Olsen and KA Murray, 1987. Morphophysiology. pp: 10–41. *In*: Laboratory Hamsters. (Van Hoosier, G. L. Jr. and McPherson, C. W. eds.), Academic Press, Orlando.

Çavdar S, U Sehirli and B Pekin, 1997. Celiacomesenteric trunk. Clinical Anatomy, 10: 231-234.

Çiçekcibasi AE, II Uysal, M Ôeker, I Tuncer, M Buyukmumcu and A Salbacak, 2005. A rare variation of the coeliac trunk. Ann Anat, 187: 387-391.

Dyce KM, WO Sack and CG Wensing, 1997. Tratado de anatomia veterinária. Rio de Janeiro: Guanabara Koogan, Cap. 7: 192.

Ferreira FA, MA Miglino, FOC Silva, FSR Carvalho and TC Santos, 2001. Origem das artérias mesentéricas cranial e caudal em fetos de caprinos da raça Saanen (Capra hircus – Linnaeus, 1758). Braz J Vet Res Anim Sci, 38: 69-73.

Hebel R and MW Stromberg, 1986. Anatomy and Embryology of the Laboratory Rat, BioMed Verlag, Wörthsee.

Ikegami R, Y Tanimoto, M Kishimoto and H Shibata, 2016. Anatomical variation of arterial supply to the rabbit spleen. J Vet Med Sci, 78: 199–202.

König HE and HG Liebich, 2004. Órgãos do sistema cardio vascular. In: Anatomia dos animais domésticos – Texto e atlas colorido. Porto Alegre: Artmed, Cap, 12: 153–188.

López-Fuster MJ and J Ventura, 1992. Arrangement of the branches of the aorta abdominalis in the wood mouse (Apodemus sylvaticus). Anat Histol Embryol. 21: 146–151.

Machado MRF, MA Miglino and VP Cabral, 2000. Origin of celiac and cranial mesenteric arteries in buffaloes (Bubalus bubalis). Braz J Vet Res Anim Sci, 37: 125-129.

McLaughlin CA and RB Chiasson, 1979. Laboratory Anatomy of the Rabbit. 2nd edn., Wm. C. Brown Company Publishers, Dubuque, Iowa.

Mohamed RAA, 2014. Arterial Supply of the Stomach of Baladi Rabbit. Indian Journal of Veterinary Anatomy 26: 14-16.

Nayar KN, G Singh, Y Singh, AP Singh and GR Singh, 1983. Comparative arteriographic anatomy of the abdominal viscera and lumbar region in goats, dogs, pigs and rabbits. The Indian Journal of Animal Sciences, 53: 1310-1314.

Nickel R, A Schummer and E Seiferle, 1983. The Anatomy of the Domestic Animals. 1.Aufl. Verlag Paul Parey, Berlin. 610p.

Nielson VG, A Weinbroum, S Tan, PN Samuelson, S Gelman and DA Parks, 1995. Xanthine oxidase inactivation attenuates post-occlusion shock after descending thoracic aorta occlusion and reperfusion in rabbits. J. Thorac. Cardiovasc. Surg, 110: 715-772.

Niza MMRE, CL Vilela, AJA Ferreira, MS Gonçalves and JM Pisco, 2003. Irrigação Arterial Hepática em Canídeo. Rev Port Ciênc Vet, 98: 69-6.

Nomina Anatomica Veterinaria, 2012. 5th ed. Published by the International Committees on Veterinary Gross Anatomical Nomenclature. Frewein, J Habel, RE.

Nowicki W, W Brudnicki, M Iwanczyk, R Jablonski and B Skoczylas, 2010. Variation in branches of the abdominal aorta in European rabbit. Electronic Journal of Polish Agriculture Universities 13: 1-9.

Özdemir V, A Çevik Demirkan and MS Akosman, 2013. Subgross and macroscopic investigation of the coeliac artery in the chinchilla (chinchilla lanigera). Folia Morphol. (Warsz) 72: 258–262.

Popesko P, V Rajtova and J Horak, 2002. A Colour Atlas of Anatomy of Small Laboratory Animals. Volume 1, Saunders, London.

Schaller O, 1999. Nomenclatura anatômica veterinária ilustrada. São Paulo: Manole, 306.

Schmidt DP and LSF Schoenau, 2007. Origem das artérias celíaca e mesentérica cranial por tronco comum em cão. Ciência Rural, Santa Maria, 37: 408-411, mar-abr.

Schwarze E, 1970. Compendio de Anatomia Veterinária. Acribia, Zaragoza. 247p.

Shively MJ and JE Stump, 1975. The systemic arterial pattern of the guinea pig: the abdomen. Anat Rec, 182: 355–366.

Tsuzaki K, 1935. The Anatomy of the Experimental Animals. Domestic Rabbit (in Japanese), Kanehara Shoten, Tokyo.

Vdoviaková K, E Petrovová, M Maloveská, L Krešáková, J Teleky, MZJ Elias and D Petrášová, 2015. Surgical Anatomy of the Gastrointestinal Tract and Its Vasculature in the Laboratory Rat. Hindawi Publishing Corporation Gastroenterology Research and Practice Volume 2016, Article ID 2632368, 11 pages http://dx.doi.org/10.1155/2016/2632368.

Ventura J and MJ López-Fuster, 1994. The arterial system of the abdominal viscera and the pelvis of the dormouse, *Eliomys quercinus* (Gliridae, Rodentia). Ann Anat, 176: 327–331.

Ventura J, MJ López-Fuster and E Gispert, 1995. Blood supply to the abdominal and pelvic regions in the Mediterranean pine vole, Microtus duodecimcostatus (Rodentia, Arvicolidae). Anat. Histol. Embryol. 24: 133–137.

Ventura J, E Gispert and MJ López-Fuster, 1996. Arterial vascularization of the abdominal and pelvic regions in the degu, *Octodon degus* (Rodentia, Octodontidae). Ann Anat, 178: 285–291.