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RESEARCH ARTICLE

Arterial Supply of the Intestine of Baladi Rabbit

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ABSTRACT

Twenty apparently adult healthy Baladi rabbit of both sexes were used in this study to demonstrate the arterial supply of the intestinal tract. Immediately after slaughtering of rabbits, the thoracic part of the aorta was injected by gum milk latex colored red with carmine just prior to its passage through the hiatus aorticus of the diaphragm. The study confirmed that the intestinal tract received its arterial blood supply primarily from the cranial and caudal mesenteric arteries. It also agreed with the fact those additional branches from gastroduodenal as well as the middle rectal and caudal rectal arteries.

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INTRODUCTION

Considering that the anatomical knowledge is necessary to understand the biological functions. According to Morandini (1968), the mesenteric arteries are responsible for the blood supply to the small and large intestine of reptiles, birds and mammals, where the digested nutrients are absorbed the epithelium and transferred to the circulation (Hildebrand, 1995). Anatomical studies on the arterial supply of the intestinal tract of the rabbit are necessary to know the pattern of its blood supply to gain information in benefit of experimental surgery, pharmacology and toxicology which can be applied to domestic animals and human.

MATERIALS AND METHODS

The present investigation was carried out on 20 adult healthy Baladi rabbits of both sexes. The animals were collected from several farms at Beni-Suef Governorate. Immediately after slaughtering of rabbits, thorough washing was done with normal saline solution via the thoracic part of the aorta. Then gum milk latex colored red with carmine was injected via the thoracic aorta just prior to its passage through the hiatus aorticus of the diaphragm. A longitudinal incision was made in the mid-ventral line of the abdominal wall starting from the xiphoid cartilage of the sternum till the anus. Careful gross dissection of the arteries of the intestinal tract was performed after fixation in 10% formalin solution. The nomenclature employed in this study was in accordance with that of the Nomina Anatomica Veterinaria (2005) and the available literatures whenever possible.

RESULTS

The intestinal tract of the Baladi rabbit received its arterial blood supply primarily from the cranial and caudal mesenteric arteries. It also received additional branches from gastroduodenal as well as the middle rectal and caudal rectal arteries of the internal iliac and internal pudendal arteries respectively.

Cranial pancreaticoduodenal artery

The cranial pancreaticoduodenal artery (Fig. 1/5) was a branch of the gastroduodenal artery (Fig. 1/3), it passed along the mesenteric border of the descending part of the duodenum giving collateral duodenal branches (Fig. 1/6) which passed within the mesoduodenum to supply the to the descending part of the duodenum and it anastomosed with a branch of the caudal pancreaticoduodenal artery of the cranial mesenteric artery.

Cranial mesenteric artery

The cranial mesenteric artery (Figs. 2/1, 3/1, 4/1, 5/1) arose from the ventral aspect of the abdominal aorta (Fig. 1/1) at the level between the first and second lumbar vertebrae, about 1.5cm caudal to the origin of the celiac

artery (Fig. 1/2). The cranial mesenteric artery entered the mesentery just after its origin. It passed ventrally inclining to the left and somewhat caudally, within the root of the mesentery, the artery lay caudal to the transverse colon flanked by the ascending colon on the right and the descending colon on the left. Along its course, the cranial mesenteric artery gave off caudal pancreaticoduodenal artery, middle colic artery, jejunal arteries, ileocaecocolic artery, ileal artery and terminated by the last jejunal artery.

Caudal pancreaticoduodenal artery

The caudal pancreaticoduodenal artery (Figs. 2/2, 3/2) issued from the right aspect of the cranial mesenteric artery, 1 cm. from the origin of the latter. It passed caudally within the mesentery of the duodenum. It divided into cranial and caudal branches (Figs. 3/3, 3/4) which gave duodenal branches to the ascending and descending limbs of the duodenum. Several anastomoses occurred between the cranial and caudal branches of the caudal pancreaticoduodenal, first jejunal artery and duodenal branches of the cranial pancreaticoduodenal artery.

Middle colic artery

The middle colic artery (Figs. 2/3, 3/5) was given off from the cranial mesenteric artery. It passed within the mesocolon towards the transverse colon where it divided into right and left branches. The right branch (Fig. 3/6) passed to the right side of the transverse colon and gave off colic twigs which supplied the right part of the transverse colon and it also anastomosed with the a branch of the right colic artery of the caudal mesenteric artery. While the left branch (Fig. 3/7) passed to the left side of the transverse colon and gave off colic twigs which supplied the left part of the transverse colon, in addition to the initial part of the descending colon. The left branch of the middle colic artery anastomosed . With the right one at the middle of the transverse colon and it also anastomosed with the left colic artery of the caudal mesenteric artery.

Right colic artery

The right colic artery (Fig. 2/5) arose from the cranial mesenteric artery distal to the origin of the middle colic artery, it passed ventrocranially towards the ascending mesocolon dividing into cranial and caudal branches to supply the terminal part of the ascending colon.

Jejunal arteries

The jejunal arteries (Figs. 2/4, 3/8, 4/2, 5/2) were 20 in number. They arose directly from the cranial convex part of the cranial mesenteric artery (4/1). The last jejunal artery was represented the termination of the cranial mesenteric artery (Fig. 5/3). Each jejunal artery passed within the mesentery and continued its course toward the mesenteric border of the jejunal convolutions, each jejunal artery divided into two main branches, cranial and caudal. The primary arches (Fig. 4/3) were formed by the anastomoses of the main branches of the neighboring arteries from which several straight twigs were given to the jejunal wall (Fig. 4/4). The cranial branch of the first duodenal branch anastomosed with the most caudal duodenal ramus of the caudal pancreaticoduodenal artery.

Ileal artery

The ileal artery (Fig. 5/4) arose from the terminal part of the cranial mesenteric artery. It passed, within the mesoileum, towards the mesenteric border of the ileum. Small twigs were detached and passed toward the wall of the ileum where it anastomosed with the one of the ileal antimesenteric arteries of the artery of the vermiform appendix of the cranial cecal artery.

Ileocaecocolic artery

The ileocaecocolic artery (Figs. 2/6, 3/9, 6/1, 8/1) sprang from the cranial mesenteric artery, passed caudoventrally within the mesocolon. Along its course, the ileocaecocolic artery gave off cranial cecal artery, accessory right colic artery, colic branches and then continued as the caudal cecal artery.

Cranial cecal artery

The cranial cecal artery (Figs. 6/2, 7/1, 8/2) originated by a common stem with the right accessory artery from the ileocaecocolic artery. It passed ventrocranially towards the terminal part of the ileocaecal fold. Along, its course, the cranial cecal artery gave off cranial and middle cecal branches (Figs. 6/3, 7/2, 6/3) to the second and third cecal gyri and ileal branches (Figs. 6/4, 7/3, 8/4) to the ileum, in addition to the artery of the vermiform appendix at the cecoappendicular junction.

The artery of the vermiform appendix

The artery of the vermiform appendix (Figs. 5/5, 6/5) arose from the cranial cecal artery. It curved caudally and to the right within ileoappendicular fold towards the apex of the vermiform appendix. Along its course, it gave off appendicular branches (Fig. 5/8) to the vermiform appendix and ileal branches (Fig. 5/7) to the ileum, in addition to the ileal antimesenteric arteries.

Anti mesenteric ileal arteries

The antimesenteric ileal arteries ((Fig. 5/6) arose from the artery of the vermiform appendix. They were 2-3 in numbers. They passed within the antimesenteric border of the ileum giving ileal branches. The larger ileal artery passed towards the mesenteric border giving ileal branches and anastomosed with the ileal artery of the cranial mesenteric artery.

Accessory right colic artery

The accessory right colic artery (Fig. 6/6) arose with the cranial cecal artery by a common trunk from the ileocaecocolic artery. It passed cranially with the ascending mesocolon where it divided into two branches which passed in the mesenteric border of the distal part of the ascending colon to supply it.

Colic branches

The colic branches (Fig. 6/7) originated from the ileocaecocolic artery. They were 3 in numbers. Two of these branches were detached by a common stem and each one was divided into a right and a left branch to the initial part of the ansa spiralis of the ascending colon. While the 3rd colic branch was arose separately and was divided also into right and left branch to supply the middle part of the ascending colon.

Caudal cecal artery

The caudal cecal artery (Figs. 6/8, 8/5) was represented the direct continuation of the ileocaecocolic artery after giving off colic branch. It passed caudoventrally towards the ampulla ilei giving off caudal cecal branches to the first gyrus, middle cecal branches to the middle part of the caecum (Fig. 6/9) and the artery of sacculus rotundus, in addition to twigs to the sacculus rotundus (Fig. 8/8) then continued as a colic artery.

The artery of sacculus rotundus

The artery of sacculus rotundus (Figs. 6/10, 8/7) arose from the caudal cecal artery, passed to the ileocaecal junction giving off twigs to the sacculus rotundus and a cecal branch to the caudal part of the caecum.

Colic artery

The colic artery (6/11, 8/9) was represented the direct continuation of the caudal cecal artery at the apex of sacculus rotundus. It passed caudoventrally towards the cecocolic fold giving off colic branches to the initial part of the ascending colon.

Caudal mesenteric artery

The caudal mesenteric artery (Fig. 9/2) descended from the ventral aspect of the abdominal aorta (Fig. 9/1) opposite the level between the 5^{th} and 6^{th} lumbar vertebrae. It passed ventrocaudally within the mesocolon where it giving the left colic artery near the sigmoid colon then continued as the cranial rectal artery.

Left colic artery

The left colic artery (Fig. 9/3) arose from the caudal mesenteric artery. It proceeded cranio-ventrally within mesocolon descendens till the initial part of the latter colon where it joined the left branch of the middle colic artery. It gave colic branches (9/4) to the descending colon.

Cranial rectal artery

The cranial rectal artery (Fig. 9/5) was the direct continuation of the caudal mesenteric artery after giving off the left colic artery. It sloped caudoventrally through the mesocolon sigmoideum then within the meso-rectum and close to the wall of the rectum, it anastomosed with the middle and caudal rectal arteries near the anus. During its course, the cranial rectal artery gave off rectal branches and sigmoid arteries. The rectal branches (Fig. 9/7) ran within the mesorectum to supply the initial part of the rectum. While the sigmoid arteries (Fig. 9/6) passed ventrally within the mesocolon sigmoideum to reach the mesenteric border of the sigmoid colon to supply it.

Middle rectal artery

The middle rectal artery (Fig. 10/4) was detached from the internal iliac artery, it followed a dorsal course, dividing into several twigs on both sides of the caudal portion of the rectum and anastomosed with the cranial and caudal rectal arteries.

Caudal rectal artery

The caudal rectal artery (Fig. 10/6) arose from the internal pudendal artery (Fig. 10/5). It passed caudodorsally to supply the caudal segment of the rectum and anus and also anastomosed with the cranial and middle rectal arteries.

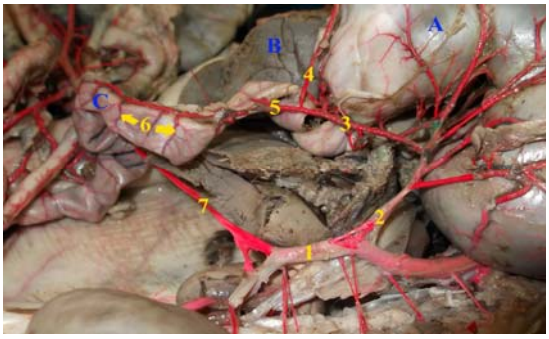

Fig. 1: A photograph showing the origin, course and distribution of the cranial pancreaticoduodenal artery of Baladi rabbit. 1: Abdominal aorta, 2: Celiac artery, 3: Gastroduodenal artery, 4: Right gastroepiploic artery, 5: Cranial pancreaticoduodenal artery, 6: Duodenal branches, A: Stomach, B: Liver, C: Duodenum.

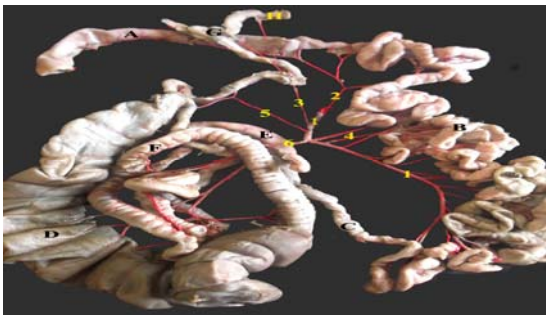

Fig. 2: A photograph showing the course and distribution of the cranial mesenteric artery of Baladi rabbit. 1: Cranial mesenteric artery, 2: Caudal pancreaticoduodenal artery, 3: Middle colic artery, 4: Jejunal arteries, 5: Right colic artery, 6: Ileocaecocolic artery, A: Duodenum, B: Jejunum, C: Duodenum, E: Vermiform appendix, F: Ascending colon, G: Transverse colon, H: Descending colon.

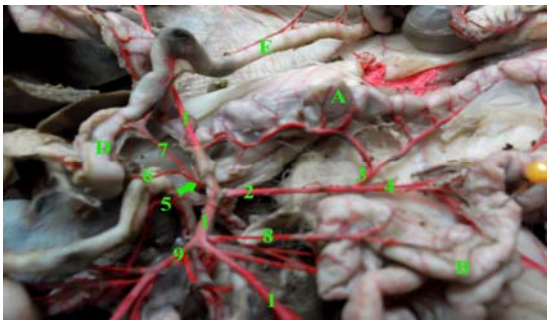

Fig. 3: A photograph showing the origin, course and distribution of the caudal pancreaticoduodenal and middle colic arteries of Baladi rabbit: 1: Cranial mesenteric artery, 2: Caudal pancreaticoduodenal artery, 3: Right branch of (2), 4: Left branch of (2), 5: Middle colic artery, 6: Cranial branch of (5), 7: Caudal branch of (5), 8: Jejunal arteries, 9: Ileocaecocolic artery, A: Duodenum B: Jejunum, D: Transverse colon, E: Descending colon.

DISCUSSION

In accordance with that given by El Nadi (1994) in rabbit, Mohamed (2008), May (1970) in sheep and Wilkens and Munster (1981) in ruminants, the cranial pancreatico-duodenal artery arose from the gastroduodenal artery and it supplied the descending duodenum.

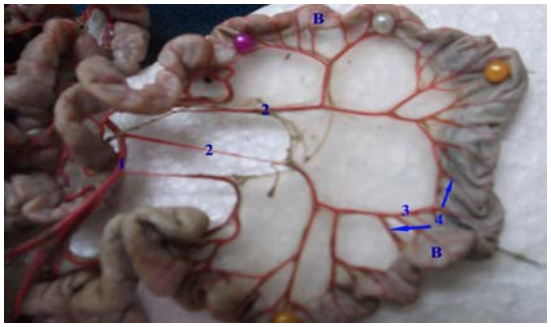

Fig. 4: A photograph showing the origin, course and distribution of the jejunal arteries of Baladi rabbit: 1: Cranial mesenteric artery, 2: Jejunal arteries, 3: Primary arches of jejunal arteries, 4: Straight twigs to the jejunal convolutions, B: Jejunum.

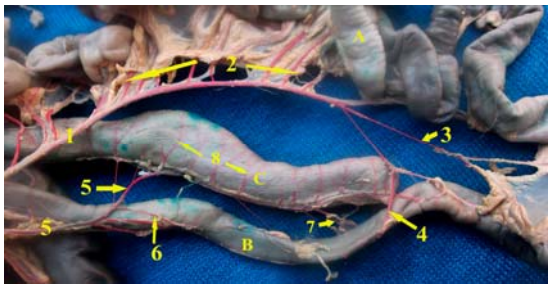

Fig. 5: A photograph showing the distribution of the ileal artery and antimesenteric ileal arteries of Baladi rabbit: 1: Cranial mesenteric artery, 2: Jejunal arteries, 3: Last jejunal artery, 4: Ileal artery, 5: Artery of vermiform appendix, 6: Antimesenteric ileal arteries, 7: Ileal branches, 8: Appendicular branches, A: Jejunum, B: Ileum, C: appendix.

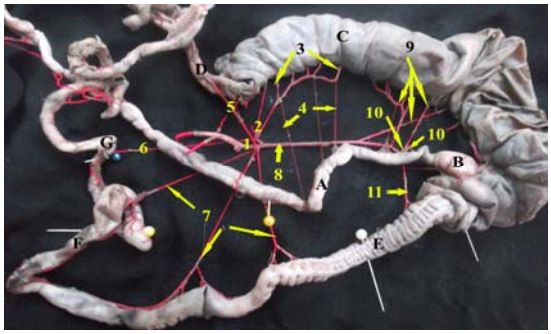

Fig. 6: A photograph showing the origin, course and distribution of ileocaecocolic artery of Baladi rabbit: 1: Ileocaecocolic artery, 2: Cranial cecal artery, 3: Cecal branches, 4: Ileal branches, 5: Artery of vermiform appendix, 6: Accessory right colic artery, 7: Colic branches, 8: Caudal cecal artery, 9: Cecal branches, 10: Artery of sacculus rotundus, 11: Colic branch, A: Ileum, B: Sacculus rotundus, C: Caecum, D: Vermiform appendix, E: Initial part of ascending colon, F: Middle part of ascending colon, G: Terminal part of ascending colon.

Gross dissection revealed that the cranial mesenteric artery in Baladi rabbit originated from the ventral aspect of the abdominal at the level between the first and second lumbar vertebrae the result which simulated that also reported in rabbit (EL Nadi, 1994). While, it originates from the ventral aspect of the abdominal aorta at the level of the first lumbar vertebra in rabbit (Guy, 1972 and Ahmed *et al.,* 1984), goat (Mohamed, 2008), sheep (Habel, 1975), horse (Wilkens and Munster, 1981) and buffalo (Barnwal *et al.,* 1982). However, the cranial mesenteric artery arises opposite the level of the second lumbar vertebra in some cases in rabbit (EL Nadi, 1994), White New Zealand rabbit (Uddin *et al.,* 2012), red fox (Bahgat, 2007), carnivores (Ghoshal, 1981), ruminants (Wilkens and Munster, 1981) and camel (Attia, 1980). On the other hand, Wally (1986) reported that the cranial mesenteric artery in camel originates at the level of the third lumbar vertebra.

The present study revealed that the cranial mesenteric artery gave off caudal pancreaticoduodenal artery, middle colic artery, jejunal arteries, ileocaecocolic artery and ileal artery. While, El Nadi (1994) in rabbit stated that the cranial mesenteric artery gives off the caudal pancreaticoduodenal artery, middle colic, right colic, the first three or four jejunal arteries, ileocolic trunk and jejunal trunk. However, Machado *et al.* (2008) in New Zealand white rabbit, Habel and Stromberg (1986) in rats, Orsi *et al.*(1975) in hamster and Machado *et al.* (1996) in Pacas mentioned that the cranial mesenteric artery issued the caudal pancreaticoduodenal artery, middle colic artery, ileocolic and jejunal branches. On the other hand, Uddin *et al.* (2012) in White New Zealand rabbit and Nayar *et al.* (1983) in rabbits, carnivores and pigs mentioned that the cranial mesenteric artery detached caudal pancreaticoduodenal artery, Middle colic, jejunal arteries and ileocaecocolic artery. Marque *et al.* (2013) in paca stated that the cranial mesenteric artery issued caudal pancreaticoduodenal, jejunal, ileocolic and cecal arteries. However, Bahgat (2007) in red fox stated that the cranial mesenteric detached caudal pancreaticoduodenal artery, jejunal arteries, ileocolic artery and ileal arteries. On the other hand, Mohamed (2008) stated that the cranial mesenteric artery in goat gives off the cranial mesenteric artery gave caudal duodenal artery, jejunal arteries, ileal arteries, ileocolic artery and middle colic artery.

The termination of the cranial mesenteric artery by the last jejunal artery. While, El- Nadi (1994) in rabbit stated that the cranial mesenteric artery terminates by dividing into jejunal and ileocolic trunks. However, Bahgat (2007) in red fox reported that the last ileal artery is represented the continuation of the cranial mesenteric artery. Mohamed (2008) in goat and Badawi *et al.* (1979) in camel reported that the cranial mesenteric artery is terminated by the last two jejunal artery. While, it terminates by the intestinal (jejunal) trunk in goat (Koch and Berg, 1985), by the middle colic and ileocolic arteries in calves (Root and Tashgian, 1971) and by the ileocolic artery or the last 6-7 jejunal arteries in camel (Wally, 1986 and Smuts and Bezuidenhout, 1987, respectively).

Concerning the caudal pancreaticoduodenal artery, it was given from the cranial mesenteric artery in the subject under investigation, thus confirming the result of Bahgat (2007) in red fox, Atalar and Yilmaz (2005) in porcupine, Constantinescu (2001) in goat, Habel (1975) in ox, Levin *et al.* (1987) in bovine, Constantinescu and Constantinescu (2004) in large ruminants, Machado *et al.* (2002) in buffalo and Wally (1986) in camel. While, Mohamed (2008) in goat mentioned the same origin of such artery under the name of caudal pancreaticoduodenal artery. Whereas, the caudal pancreaticoduodenal artery originated from the middle colic artery in rabbits,

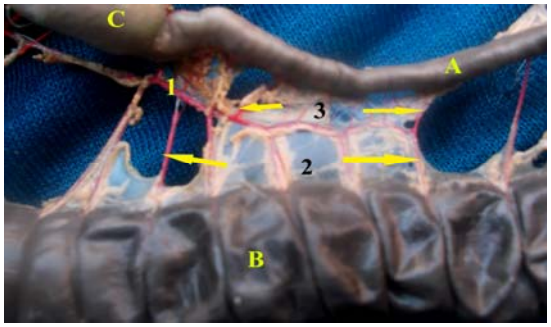

Fig. 7: A photograph showing the cecal and ileal branches of the cranial cecal artery of Baladi rabbit: 1: Cranial cecal artery, 2: cecal branches, 3: Ileal branches, A: Ileum, B: Caecum C: Sacculus rotundus.

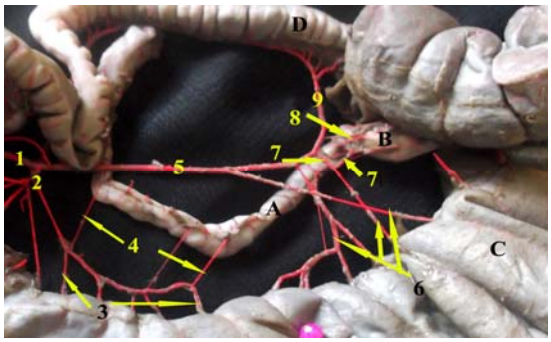

Fig. 8: A photograph showing the origin, course and distribution of caudal cecal artery of Baladi rabbit: 1: Ileocaecocolic artery, 2: Cranial cecal artery, 3: Cecal branches, 4: Ileal branches, 5: Caudal cecal artery, 6: Cecal branches, 7: Artery of sacculus rotundus, 8: Twigs to sacculus rotundus, 9: Colic artery, A: Ileum, B: Sacculus rotundus, C: Caecum, D: Ascending colon.

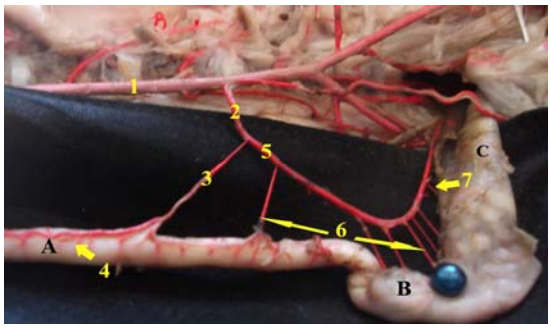

Fig. 9: A photograph showing the origin, course and distribution of the caudal mesenteric artery of Baladi rabbit: 1: Abdominal aorta, 2: Caudal mesenteric artery, 3: Left colic artery, 4: Colic branches, 5: Cranial rectal artery, 6: Sigmoid arteries, 7: Rectal branches, A: Descending colon, B: Sigmoid colon, C: Rectum.

carnivores and pigs (Nayar *et al.*, 1983) and from the jejunal artery in camel (Smuts and Bezuidenhout, 1987).

The recent results were identical with those registered by El Nadi (1994) in rabbit, Green (1963) in rat and Cook (1965) in mouse where the caudal pancreaticoduodenal artery is the first branch of the cranial mesenteric artery. While, Cakir (1991) in cat and Atalar and Yilmaz (2005) in 2 of 9 porcupine stated that the caudal pancreaticoduodenal artery is the second branch of the cranial mesenteric artery. On the other hand, Atalar and

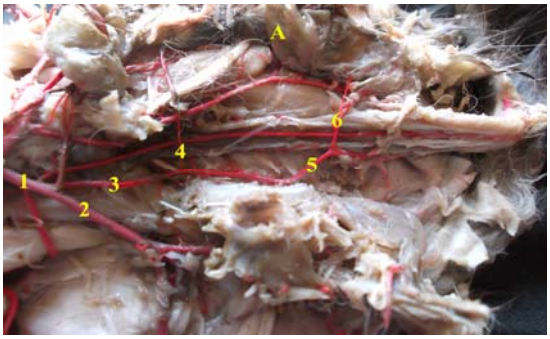

Fig. 10: A photograph showing the origin, course and distribution of the middle rectal and caudal rectal arteries of Baladi rabbit: 1: Common iliac artery, 2: External iliac artery, 3: Internal iliac artery, 4: Middle rectal artery, 5: Internal pudendal artery, 6: Caudal rectal artery, A: Rectum.

Yilmaz (2005) in porcupine stated that the caudal pancreaticoduodenal artery is the third branch after the middle colic and right colic arteries.

Regarding the middle colic artery, our findings coincided with those gained in White New Zealand rabbit (Uddin *et al.*, 2012), guinea pig (Favre, 1967), cat (Smallwood and Sis, 1973), porcupine (Atalar and Yilmaz, 2005), goat (Mohamed, 2008), sheep (May, 1970), ox (Habel, 1975), bovine (Levin *et al.*, 1987) and buffalo (Barnwal *et al.*, 1982), where it originated from the cranial mesenteric artery. While, Bahgat (2007) in red fox stated that the middle colic artery is the first branch that given from the ileocolic artery. On the other hand, such artery in camel arose from the right colic artery Wally, 1986).

The recent results were identical with those registered by El Nadi (1994) in rabbit, Favre (1967) in guinea pig, Smallwood and Sis (1973) in cat, Bahgat (2007) in red fox, Atalar and Yilmaz (2005) in porcupine Mohamed (2008) in goat, May (1970) in sheep, Habel (1975) in ox, and Barnwal *et al.* (1982) in buffalo stated that the middle colic artery is represented by a single vessel. While, Ahmed *et al.* (1984) in rabbit, El Nadi (1994) in 8 specimens of rabbit, Uddin *et al.* (2012) in White New Zealand rabbit frequently and Habel and Stromberg (1986) in rat stated that there are two medial arteries. On the other hand, the middle colic artery in camel is represented by 4-6 branches (Wally, 1986).

The obtained results were similar to those mentioned by El Nadi (1994) in rabbit, Bahgat (2007) in red fox, Atalar and Yilmaz, (2005) in porcupine, Constantinescu and Constantinescu (2004) in large ruminants and Wally (1986) in camel who reported that the right colic artery originated from the cranial mesenteric artery. While, El Nadi (1994) in 6 specimens of rabbit, Habel (1975) in goat, sheep and ox, Budras *et al.* (2003) in bovine and Barnwal Machado *et al.* (2002) in buffalo reported that the right colic arteries arise from the proximal part of the ileocolic artery.

The recent results were identical with those registered by El Nadi (1994) in rabbit, Bahgat (2007) in red fox, Atalar and Yilmaz, (2005) in porcupine where the right colic artery is represented by a single artery. While, Youssef (1991) in goat and Wilkens and Munster (1981) in ruminants stated that the right colic arteries are 2 - 3 in

number and they arise by common with the colic branches.

The number of the jejunal arteries was quite different among domestic animals. They were 20 in our investigation. thus confirming the result of Craigie (1948) in rabbit. While the jejunal arteries in rabbit are 14, 17-19, 18-20 or 19-22 (Ahmed *et al.*, 1984, Guy, 1972, Uddin *et al.*, 2012 or EL Nadi, 1994) respectively, 8 in red fox (Bahgat, 2007), 24-27 in goat (Mohamed, 2008),18-28 in sheep (Happich, 1961), 10-15 in porcupine (Atalar and Yilmaz, 2005), 37 in buffalo (Machado *et al.*, 2002) and 6-7 in camel (Wally, 1986).

Our findings as well as those obtained by Bahgat (2007) in red fox, Habel (1975) in ox, Machado *et al.* (2002) in buffalo and camel Wally (1986) in camel ascertained that the jejunal arteries were detached from the cranial mesenteric artery along its whole length. While, Cakir (1991) and El Nadi (1994) in rabbit, Perneczky (1969) in guinea pig and Atalar and Yilmaz (2005) in porcupine stated that the jejunal arteries arise from the cranial mesenteric artery and jejunal trunk. However, Koch and Berg (1985) in goat mentioned that the jejunal arteries originate from the intestinal trunk of the cranial mesenteric artery.

The present result stated that the ileal artery is represented by a single artery. While Bahgat (2007) in red fox stated that ileal arteries are represented by 3-4 branches. However they are 3-7 in number as recorded in goat simulated that reported by Mohamed (2008).

Our findings were in an accordance with those gained by Bahgat (2007) in red fox, Mohamed (2008) in goat, Habel (1975) in ox and Machado *et al.* (2002) in buffalo who said that the ileal artery arise from the terminal part of the cranial mesenteric artery While, Atalar and Yilmaz (2005) in porcupine stated that the ileal branch arose from the last jejunal artery. However, Koch and Berg (1985) recorded that the ileal arteries in goat arise from the intestinal trunk.

Concerning the ileocaecocolic artery, it was given from the cranial mesenteric artery in the subject under investigation, thus confirming the result obtained by Craigie (1948) in rabbit and Uddin *et al.* (2012) in White New Zealand rabbit, Nayar *et al.* (1983) in rabbits, carnivores and pigs and Sisson and Grossman (1969) in ox. While, El Nadi, (1994) in rabbit, Mohamed (2008) in goat, Maala and Sack (1981) in ox, Nickel *et al.* (1981) in domestic animals, Machado *et al.* (2002) in buffalo and Badawi *et al.* (1979) in camel mentioned the same origin of such artery under the name of ileocolic artery. While the ileocolic artery represents the direct continuation of the cranial mesenteric artery in rat (Cook, 1965), porcupine (Atalar and Yilmaz, 2005)and camel (Wally, 1986).

Our findings were in an accordance with those gained by El Nadi (1994) in rabbit who said that the ileocolic trunk gave off the cranial cecal artery and the accessory right colic artery, three rami colici and then continues as the caudal cecal artery. While, Craigie (1948) in rabbit and Uddin *et al.* (2012) in White New Zealand rabbit stated that the ileocaecocolic artery gives small branches the ascending colon, appendicular artery, anterior ileocaecal artery, anterior right colic artery, posterior right colic artery, posterior ileocaecal artery, caecal artery and terminal branches to the parts of the ileum, caecum, and colon. However, Bahgat (2007) in red fox stated that the ileocolic artery detaches middle colic, a stem vessel which divided into colic branch and right colic artery, mesenteric ileal artery and continued as cecal artery. Atalar and Yilmaz (2005) in porcupine stated that the ileocolic artery is divided into colic branch, colic branches, mesenteric ileal branch and cecal artery. Mohamed (2008) in goat mentioned that the ileocolic artery gave off a common trunk for 2-3 colic branches and 3-5 right colic arteries, in addition to 3-5 colic branches and mesenteric ileal artery and continues as cecal artery. On the other hand, May (1970) in sheep asserted that the ileocolic artery passes caudally giving colic branches to the ascending colon and continues as the ileocaecal artery which divides into ileal and cecal arteries. Budras *et al.* (2003) in bovine stated that the ileocolic artery gives off right colic arteries, 3 - 4 colic branches and mesenteric ileal artery. Machado *et al.* (2002) in buffalo achieved that the ileocolic artery gives off colic branches in a common trunk, 2-3 right colic arteries and near the ileocaecal area, it divides into cecal and mesenteric ileal branch.. In camel (Wally, 1986), the ileocolic artery, detaches 4 - 6 colic arteries, two mesenteric ileal arteries, 1- 2 branches to the ansa proximalis of the ascending colon, and then continues as the cecal artery.

Observations of the present study confirmed those of by El- Nadi (1994) in rabbit and Atalar and Yilmaz (2005) in porcupine, where the cecal artery arose from the ileocolic artery. While, the cecal artery is described to be the direct continuation of the ileocolic artery in red fox (Bahgat, 2007), goat (Mohamed, 2008), ox (Habel, 1975), buffalo (Barnwal *et al.*, 1982) and camel (Wally, 1986). In this respect, May (1970) in sheep, Raghavan and Kachroo (1964) in ox and Machado *et al.* (2002) in buffalo stated that the cecal artery is one of the two terminals of the ileocaecal artery.

The current investigation, corresponding with those of El Nadi (1994) in rabbit, clarified that the cranial cecal artery detaches the artery of appendicular vermiformis, cranial and middle cecal branches and ileal branches. Moreover, the cecal artery detaches cecal and antimesenteric ileal branches and continued as the antimesenteric ileal artery as recorded by Mohamed (2008) in goat, Wilkens and Munster (1981) in ruminants, Habel (1975) in ox and Machado *et al.* (2002) in buffalo.

The current work revealed that the artery of the vermiform appendix arose from the cranial cecal artery and it gave off appendicular branches to the vermiform appendix as well as ileal branches and antimesenteric ileal arteries to the ileum, confirmed those given by El Nadi (1994) in rabbit. While, by Craigie (1948) in rabbit and Uddin *et al.* (2012) in White New Zealand rabbit stated that the appendicular artery arose from the ileocaecocolic artery to the vermiform process.

Our findings mentioned that the antimesenteric ileal arteries are 2-3 in numbers while, El Nadi (1994) in rabbit stated that the antimesenteric ileal branch is divided into two unequal branches.

In agreement with that described by El Nadi (1994) in rabbit that the 3 colic branches of the ileocaecocolic artery supplied the initial and middle parts of the ascending colon. Moreover, Mohamed (2008) in goat, Budras *et al.*

(2003) in bovine, Machado *et al.* (2002) in buffalo and Wally (1986) in camel recorded that the colic branches of the ileocolic artery supply both ansa proximalis and centripetal gyri of the ascending colon.

Observation of the present study confirmed those of El Nadi (1994) in rabbit that the accessory right colic artery arose with the cranial cecal artery from the ileocaecocolic artery to supply the ascending colon.

The recent results were identical with those registered by El Nadi (1994) in rabbit that the caudal cecal artery represents the direct continuation of the ileocolic trunk and it gives middle and caudal cecal branches to the caecum and the artery of the sacculus rotundus to the sacculus rotundus.

The current work revealed that the artery of the sacculus rotundus gave off twigs to the sacculus rotundus and a cecal branch to the caudal part of the caecum. A result which not recorded by other authors.

The recent result stated the caudal cecal artery gave off several direct twigs to the sacculus rotundus, a result which not recorded by other authors.

Concerning the colic artery, it was represented the direct continuation of the caudal cecal artery at the apex of sacculus rotundus. While, El Nadi (1994) in rabbit stated that the colic branch is given from the caudal cecal artery.

The under investigation. While, El Nadi (1994) in rabbit stated that the colic branch of the caudal cecal artery which divides into a longer cranial branch to the initial part of the ascending colon and a smaller branch to the cecocolic junction.

Our findings were in an accordance with those gained by El Nadi (1994) in rabbit who said that the colic artery giving off colic branches to the initial part of the ascending colon.

The caudal mesenteric artery took its origin from the ventral aspect of the abdominal aorta at the level between the 5^{th} and 6^{th} lumbar vertebra, confirming what given by Ahmed *et al.* (1984) in rabbit, El Nadi (1994) in some cases of rabbit and Habel (1975) in goat and sheep. While, El Nadi (1994) in rabbit, Uddin *et al.* (2012) in White New Zealand rabbit and Bahgat (2007) in red fox stated that the caudal mesenteric artery arose from the ventral aspect of the abdominal aorta, opposite to the 6^{th} lumbar vertebra. However, it originates opposite the level of 5^{th} lumbar vertebra as reported by Mohamed (2008) in goat, Wilkens and Munster (1981) in small ruminants and Raghavan and Kachroo (1964) in ox. On the other hand, it arises opposite to of the 5^{th} or 6^{th} lumbar vertebra in camel (Wally, 1986).

The recent results were identical with those registered by Ahmed *et al*. (1984) and El Nadi (1994) in rabbit that the caudal mesenteric artery detaches the left colic artery then continues as the cranial rectal artery. While, Craigie (1948) and McLaughlin and Chiasson (1979) in rabbit stated that the caudal mesenteric artery gives of the left colic artery and cranial hemorrhoidal artery. On the other hand, and Uddin *et al*. (2012) in White New Zealand rabbit, Mohamed (2008) in goat, Koch and Berg (1985) in goat, sheep and ox, Wilkens and Munster (1981) in ruminants, Raghavan and Kachroo (1964) in ox, Machado *et al.* (2002) in buffalo and Wally (1986) in camel, described that the caudal mesenteric artery gives off the left colic and cranial rectal arteries. While, Nayar *et al.* (1983) in rabbits, carnivores and pigs mentioned that the caudal mesenteric artery gives off the cranial and caudal anastomatic branches.

The obtained results were similar to those mentioned by El Nadi (1994) in rabbit, Bahgat (2007) in red fox, Mohamed (2008) in goat, Habel (1975) in ox, Budras *et al.* (2003) in bovine, Wilkens and Munster (1981) in ruminants and Wally (1986) in camel stated that the left colic artery supplies the descending colon.

The current work revealed that the cranial rectal artery arising from the caudal mesenteric artery gave off rectal branches to the rectum and anastomosed with the middle and caudal rectal arteries. Such results confirmed those given by El Nadi (1994) in rabbit, Mohamed (2008), May (1970) in sheep, Habel (1975) in ox, Wilkens and Munster (1981) in ruminants, Machado *et al.* (2002) in buffalo and Wally (1986) in camel.

Our observations declared that the sigmoid arteries arose from the cranial rectal artery to supply the sigmoid colon. Such observations were in accordance with that stated by El- Nadi (1994) and Machado *et al.* (2008) in rabbit, Marque *et al.* (2013) in paca and Machado *et al.* (2002) in buffalo. While, Mohamed (2008) in goat stated that the sigmoid arteries arose from both the left colic and cranial rectal arteries. However, the sigmoid arteries were detached from the caudal mesenteric artery itself in ruminants (Wilkens and Munster, 1981) and bovine (Budras *et al.*, 2003).

In agreement with that described by Craigie (1948) in rabbit, May (1970) in sheep, Wilkens and Munster (1981) in sheep and ox and Smuts and Bezuidenhout (1987) in camel, the present study revealed that the middle rectal artery arose from the internal pudendal artery. This result that may be due to the absence of the urogenital rabbit as it recorded by Orsi *et al.* (1979) in rabbit. While, El Nadi (1994) in rabbit, Mohamed (2008) in goat, Habel (1975) in goat and sheep and ox stated that the middle rectal artery arose from the urogenital artery. However, Wally (1986) reported that the middle rectal artery arises from the ventral perineal artery in camel. On the other hand, and Graziott *et al.* (2007) in llama. Reported that the middle rectal artery is absent.

The origin of the caudal rectal artery from the internal pudendal artery, a result which was also recorded by Orsi *et al*. (1976) and El Nadi (1994) in rabbit, May (1970) in sheep and Habel (1975) in ox. While, it arose from the dorsal perineal artery as recorded by Wilkens and Munster (1981) in goat and ox and Habel (1975) in cow. However, it arises from the ventral perineal artery in male goat (Yadm, 1988), Graziott *et al*. (2007) in llama and camel (Wally, 1986). However, Yadm (1988) stated that the caudal rectal artery is the continuation of the dorsal perineal artery in female goat. On the other hand, Constantinescu (2001) in goat and Habel (1975) in goat and sheep reported that the caudal rectal artery originates either from the dorsal or ventral perineal arteries. Orsi *et al.* (1979) in rabbit stated that he internal pudendal artery is the direct continuation of the internal iliac artery and gives to rise to some visceral branches that irrigate the rectum.

It was observed in our study as well in rabbit (El Nadi, 1994), sheep and goat (Habel, 1975), ox (Raghavan

and Kachroo (1964) and camel (Wally, 1986) that the caudal rectal artery supplies the caudal segment of the rectum, in addition to the anus, while Saber (1979) in the latter animal stated that such an artery supplies only the anal canal and orifice.

Conclusion

The parts of the intestinal tract of the Baladi rabbit were supplied by the following branches. The duodenum was supplied by the duodenal branches of the cranial and caudal pancreaticoduodenal arteries. The jejunum was supplied via the jejunal arteries. The ileum was supplied by the ileal artery, ileal branches and antimesenteric ileal arteries of the artery of vermiform appendix. The sacculus rotundus was supplied by the artery of sacculus rotundus and numerous twigs of the caudal cecal artery. The caecum was supplied by the cecal branches of the cranial and caudal cecal arteries and cecal branch of the artery of sacculus rotundus. the vermiform appendix was supplied by the artery of vermiform appendix. The ascending colon was supplied via colic branches, right colic and accessory right colic artery. The transverse colon is supplied by the middle colic artery. The descending colon was supplied by the left colic artery. The sigmoid colon is supplied by the sigmoid arteries. The rectum and anus were supplied by the cranial, middle and caudal rectal arteries.

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REFERENCES

Ahmed AK, IA Ibrahim and ME Abdel-Moneim, 1984. Arterial vasculature of the gastrointestinal tract in the rabbit. Assiut Vet Med J, 13: 155-270.

Atalar O and S Yilmaz, 2005. The cranial mesenteric artery in porcupine (Hystrix cristata). Veterinarski Archiv, 75: 75-82.

Attia M, 1980. Anatomical studies on the arterial supply of the trunk in one humped Camel (camelus dromedarius). M.V.Sc. Thesis, Faculty of Veterinary Medicine, Assuit University, Egypt.

Badawi H, IS Ibrahim and Khammass, 1979. Band III. Die drossen Versorgungs- und Steuerungs- systems. Veb Gustav Fisher Verlag, Jena.

Bahgat H, 2007. Some anatomical studies on the mesenteric arteries in the red fox (Vulpes vulpes). Ph. D. Thesis. Faculty of Veterinary Medicine Benha, University, Egypt.

Barnwal AK, DN Sharma and LD Dhingera, 1982. Anatomical and roentgenographic studies on the cranial mesenteric artery of buffalo. Haryana Vet, 21: 1-5.

Budras KD, RE Habel, A Wünsche and S Buda, 2003. Bovine anatomy (An illustrated text). Ist ed, Schlütersche GmbH and Co KG, Verlag und Druckerei, Hanover, Germany, pp: 76-77.

Cakir A, 1991. Yerli Kedi (Felis domestica L.) ve Beyaz Yeni Zelanda Tavsanı'nin (Orcytolagus cuniculus L.) Aorta Abdominalis'i ve Verdigi Kollar Uzerinde Karsilastirmali Anatomik Calismalar. [Doktora Tezi] AU Sag Bil Enst, Ankara.

Constantinescu, GM, 2001. Guide to regional ruminant anatomy based on the dissection of the goat. Ist ed., Iowa state university press/Ames, pp: 104-131.

Constantinescu GM and IA Constantinescu, 2004. Clinical dissection guide for large animals, horse and large ruminants. 2nd ed., Iowa state press, Blackwell Publishing Company, pp: 302-303.

Cook, JM, 1965. Circulatory System. In: Cook, JM (Ed). The Anatomy of the Laboratory Mouse. Academic Press, London, England: 87-88.

Craigie H, 1948. Bensley's practical anatomy of the rabbit. An elementary laboratory text book in mammalian anatomy, 8th edition, the blakistoh compahx, philadelphia.

El Nadi FAM, 1994. Some gross anatomical studies on the distribution of the arteries of the post diaphragmatic digestive tract of the rabbit. MVS thesis, Faculty of Veterinary Medicine, Cairo University, Egypt.

Favre P, 1967. Contribution á l'Etude du Systeme Arteriel du Cobaye. (Abdomen, Bassin, Membre pelvien). These Ecole Nationale Veterinaire d'Alfort, Paris.

Ghoshal NG, 1981. Coração e artérias. In: Getty, R (Ed.). Anatomia dos Animais Domésticos. 5 ed. Interamericana, Rio de Janeiro, Brasil, pp: 560-562.

Graziotti GH, JMR Menendez, CM Rios and CL Victoria, 2007. Distribution of the internal pudendal artery in male and female llama (Lama glama). Ann Anat 189 : 295-298.

Green EC, 1963. Anatomy of the Rat. Transaction of the American Philosophical Society Held at Philadelphia, For Promoting Usefull Knowledge. New Series. Volume XXVII, Hafner Publishing Company, New York.

Guy B, 1972. Contribution A Petude De L'aorta Abdominale et De ses collaterals chez la lapin Domestique (Oryctolagus Cuniculus L.). These Pour Le Doctorate Veterinarire, Alfort, France.

Habel RE, 1975. Abdominal aorta of ruminants. In Getty, R, 1975. The anatomy of the domestic animals. 5th ed., W.B. Saunders, philadelphia, London, Toronto, pp: 982-991, 1016-1022.

Habel R and MW Stromberg, 1986. Anatomy and embryology of the laboratory rat. Biomed Verlag, Wörthsee, Germany, pp: 270.

Hildebrand M, 1995. Análise da estrutura dos vertebrados. Atheneu, São Paulo, Brasil, pp: 263.

Koch T and R Berg, 1985. Lehrbuch der Veterinar Anatomie. Band III. Die drossen Versorgungs-und Steuerungs-systems. Veb Gustav Fisher Verlag, Jena.

Levine SA, DF Smith, J Wilsman and Ds Kolb, 1987. Arterial and venous supply to the bovine jejunum and proximal part of the ileum. Amer J Vet Res, 8: 1295-1299.

Maala CM and WO Sack,1981. The arterial supply to the ileum, cecum and the proximal loop of the ascending colon in the ox. Zbl Vet Med, 10: 130-146.

Machado MRF, TMR Nogueira, MA Miglino, SMB Artoni, ML Araújo and Ml Gianonni, 1996. Ramifi cação da arteria mesentérica cranial e artéria

mesentérica caudal da Paca (Agouti paca, Linnaeus, 1766). Anais do Congresso Brasileiro de Anatomia, Ceará, Brasil, pp: 29.

Machado MRF, MA Miglino, LJA Didio, D Honsho, Oliveira and EMC Borges, 2002. The arterial supply of buffalo intestines (Bubalus Bubalis). Buffalo Journal, 18: 249-256.

Machado MRF, SV Souza and TC Oliveira, 2008. Suprimento arterial dos intestinos do coelho da raça Nova Zelândia (Oryctolagus cuniculus). Biotemas, 21: 101-105.

Marques ICS, SPG Fihlo, LL Martins, LM Leal and ACG Reis, 2013. Artérias mesentéricas cranial e caudal da paca (Cuniculus paca, L. 1766). Biotemas, 26: 165-17.

May NDS, 1970. The anatomy of the sheep. 2nd ed, University of Queen Land Press Australia.

McLaughlin CA and RB Chiasson,1979. Laboratory Anatomy of the Rabbit. 2nd ed., Wm. C Brown Company Publishers, Dubuque, Iowa, pp: 46.

Mohamed RA, 2008. Some morphological studies on the arterial supply and venous drainage of the gastrointestinal tract in goat MVS Thesis, Faculty of Veterinary Medicine, Beni Suef University, Egypt.

Morandini C, 1968. Zoologia. 2nd ed. Nobel, São Paulo, Brasil, pp: 1196.

Nayar KNM, G Singh, Y Singh, AP Singh and HGR Singh, 1983. Comparative arteriographic anatomy of the abdominal viscera and lumbar region in goats, dogs, pigs and rabbits. Indian J Anim Sci, 53: 1310-1314.

Nickel R, A Schummer, E Seiferle and WO Sack, 1981. The circulatory system, the skin, and the cutaneous organs of the domestic mammals. Verlag Paul Parey, Berlin, Germany, pp: 588.

Nomina Anatomica Veterinaria, 2005. 5th edition, prepared by the international Committee on Veterinary Gross Anatomical Nomenclature (ICVGAN) and authorized by the General Assembly of the World Association of Veterinary Anatomists (WAVA) Knoxvilla, TN (USA) 2003. Published by the Editorial Committee Hanover, Cloumbia, Gent, Sapporo.

Orsi AM, P Pinto e Silva, S Mello-Dias and MC Oliveira, 1975. Considerações sobre a remescência da aorta abdominal do hamster dourado (Mesocricetus auratus). Revista Brasileira de Pesquisas Médicas Biológicas, 8: 459-462.

Orsi AM, PPE Silva, VJM Campos and Z Silva, 1976.Considerac.Es Sober Os Ramos Visceralis Da Arteria Pudenda Interna Do Coelho (Oryctolagus cuniculus). Revew Faculty Medicine Veteterinary Zootec University S Paulo, 13: 459-63.

Orsi AM, P Pinto e Silva, MA Fernandes de Abreu and S Mello Dias, 1979. Pelvic visceral arteries of rabbits Oryctolagus cuniculus). Acta Anat (Basel). 104: 72-8.

Raghavan D and P Kachroo, 1964. Anatomy of the ox. 1st ed, Indian Council of Agriculture Research, New Delhi, 530-531, 570.

Root CR and RJ Tashgian, 1971. Thoracic and abdominal arteriography in calves. Amer J Vet Res, 32: 1193-1205.

Saber ASM, 1979. The arteries and veins of the pelvic limb of the camel with special referance to the angioarchitecture of the foot pad. PhD Thesis, Faculty of Veterinary Medicine, Assuit University, Egypt.

Sisson S and HD Grossman, 1969.The anatomy of the domestic animals. 4th ed, WB Sauders Company, Philadelphia and London, pp: 726-730.

Smallwood JE and RF Sis, 1973.Selective arteriography in the cat. Amer J Vet Res, 34: 955-963.

Smuts MMS and AJ Bezuidenhout, 1987. Anatomy of the Dromedary. Clarendon press, Oxford, pp: 156-170: 175-177.

Uddin M, ML Rahman, MA Alim and ASML, 2012. Anatomical study on origin, course and distribution of cranial and caudal mesenteric arteries in the White New Zealand rabbit (Orycotolagus cuniculus). International Journal of Natural Sciences, 2: 54-59.

Wally YR, 1986. Some anatomical observations on the intestinal tract of the one humped camel (camelus dromedarius). M.V.Sc. Thesis, Faculty of Veterinary Medicine, Cairo University, Egypt.

Wilkens H and Munster, 1981. The circulatory system. In Nickel A, R Schumer and E Seiferle, 1981.The anatomy of the domestic animals, Vol III. Trans. By Siller, WG and PA Wright Verlag Paul Parey, Berlin und Hamburg., pp: 159-183, 260-268.

Yadm ZA, 1988. Some anatomical studies on the perineum of the goat. PhD Thesis, Faculty of Veterinary Medicine, Cairo University, Egypt.