ANIMAL SCIENCE AND GENETICS
Published by the Polish Society of Animal Production
vol. 20 (2024), no 2, 27-39
DOI: 10.5604/01.3001.0054.6424
Research Article ***Open Access***

The arterial vascularization of the gastrointestinal tract of the Common pheasant (*Phasianus colchicus*)

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SUMMARY

The common pheasant has been the subject of scientific research, although it has not yet been analysed as thoroughly as other domestic birds. It has spread to many parts of the world and adapted to diverse environments. A study was conducted on 30 carcasses of female common pheasants. The aim of the study was a comparative analysis of the anatomy of vessels supplying the digestive system of the pheasant. The anatomical study of the arteries revealed that the celiac artery originates from the right part of the descending aorta. Its branches include the proventriculus artery, which supplies blood to the proventriculus and oesophagus and also supplies the spleen, the duodenum, and the initial segment of the large intestine. Both the left and right branches of the celiac artery give off numerous branches that reach different areas of the intestines and stomach, forming a complex network of vessels. The cranial mesenteric artery is a crucial vessel supplying the small and large intestines, while the caudal mesenteric artery supplies the final segment of the large intestine and cloaca. Additionally, the pudendal arteries are responsible for the vascularization of the cloaca and surrounding structures in this species. These detailed anatomical observations are important for understanding blood circulation in pheasants.

KEY WORDS: anatomy, artery, birds, gastrointestinal tract

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Received: 4.05.2024 Received in revised form: 20.05.2024
Accepted: 22.05.2024 Published online: 23.05.2024

INTRODUCTION

The common pheasant (*Phasianus colchicus*) is an intriguing scientific research subject. In terms of anatomy, it has not been analysed as thoroughly as other domestic birds, such as the domestic chicken (*Gallus gallus*), the wild turkey (*Meleagris gallopavo*), the domestic goose (*Anser domesticus*), or birds of the duck family (Anatidae) (Korbel et al., 2016, Komarek et al., 1982). As a species initially inhabiting parts of Asia, the common pheasant is alien to the native fauna of Poland. The species has spread to many other parts of the world through introductions, including Europe and North America. The geographic expansion of pheasants is associated with their ability to adapt to diverse natural environments, as they demonstrate significant flexibility in selection of habitat, including forested areas and agricultural lands (Chiatante and Meriggi, 2022). Pheasants are game birds, classified as small game. Although they are not listed as domesticated animals, pheasant farms existed until recently, raising birds which were later released into hunting grounds or exported to various European countries. Pheasants are omnivorous birds adapted to living in diverse environments, from forests to agricultural areas (Schöll et al., 2023), and their diet includes seeds, insects, and small animals. They also play an integral role in ecosystems and perform essential functions in the structure and functioning of local food webs. As an omnivorous species, they contribute to regulating populations of various plant and animal species, both as consumers and prey for predators (Riley and Shulz, 2001). Their foraging activity and social behaviour directly impact biodiversity and habitat structures where they occur. Consequently, some may perceive the presence of pheasants in such environments negatively. Nevertheless, predatory and insectivorous species, including pheasants, are considered beneficial, as they help maintain control over crop pests (Mariyappan, 2023).

In domestic birds, the arterial supply to the intestines begins from the descending aorta (*aorta descendens*). From here the solid celiac artery (*a. celiaca*) branches off, which first gives rise to the dorsal proventricular artery (*a. proventriculus dorsalis*), whose extension becomes the dorsal gastric artery (*a. gastrica dorsalis*). The celiac artery splits into two branches – the right branch (*ramus dexter arteriae celicae*) and the left branch (*ramus sinister arteriae celicae*).

The first branches of the right branch of the celiac artery are the splenic arteries (*aa. lienales*), supplying blood to the spleen (*lien*). Some authors also distinguish additional splenic branches. Further towards the liver (*hepar*), the right hepatic artery (*a. hepatica dextra*) branches off and gives rise to hepatic branches (*rami hepatici*) and arteries of the gallbladder (*a. vesicae biliaris*). Additionally, it gives off a relatively long duodenojejunal artery (*a. duodenojejunalis*). Another branch of the right branch of the celiac artery is the ileocecal artery (*a. ileocecalis*), which supplies blood to the blind intestines (*cecum*). Next, the pancreaticoduodenal artery (*a. pancreaticoduodenalis*) branches off. In further terminal branches, smaller arterial vessels can be classified, such as the dorsal branch (*r. dorsalis*) and the ventral branch (*r. ventralis*), giving off branches to the caudal gastric sac (*rr. sacci caudalis*). First, from the left branch of the celiac artery, the ventral proventricular artery (*a. proventriculus ventralis*) and cranial sac branches (*rr. sacci craniales*) branch off. The next bifurcation leads to the ventral gastric artery (*a. gastrica ventralis*), which is involved in liver perfusion through the left hepatic arteries (*aa. hepatica sinistra*). Further, the left gastric artery (*a. gastrica sinistra*) branches off, and its extensions become the dorsal branches. The branch of the celiac artery itself ends as ventral branches that assist in perfusion of the caudal part of the stomach.

The left and right branches of the celiac artery join via the left and right hepatic branches, forming the hepatic arterial anastomosis (*anastomosis arteriarum hepaticarum*). The anastomosis gives off median branches (*rr. mediani*) spreading within the liver lobes. The second vital artery of the digestive system is the cranial mesenteric artery (*a. mesenterica cranialis*). It arises from the descending aorta just below the celiac artery. This artery, in turn, gives off arteries corresponding to various sections of the intestine, including the duodenojejunal artery (*a. duodenojejunalis*), jejunal arteries (*aa. jejunales*), ileal arteries (*aa. ileales*), marginal artery of the small intestine (*a. marginalis intestini tenuis*), synsacral segmental arteries (*aa. segmentales synsacrales*), and vertebromedullary artery (*a. vertebromedullaris*). Of lesser importance is the caudal mesenteric artery (*a. mesenterica caudalis*), which gives off cranial and caudal branches, supporting the perfusion of the large intestine (*intestinum crassum*) and cloaca (*cloaca*) (Baumel et al., 1993).

This study presents the vascular supply of the digestive system of the common pheasant, covering segments from the proventriculus through the ventriculus, small intestine, and large intestine to the cloaca. This research aims to gain detailed knowledge of the vascular anatomy supplying various parts of the digestive tract in adult females of this species.

MATERIALS AND METHODS

Thirty carcasses of female common pheasants (*Phasianus colchicus*) were used in the study. All birds were obtained from breeding facilities cooperating with the Institute of Veterinary Medicine at Nicolaus Copernicus University in Toruń. Ethics committee approval was not required, as the material was obtained posthumously. Red latex LBS 3060 was injected into the aorta of each individual, and then the samples were immersed in a 5% formalin solution and left for 14 days to preserve tissue structure. After this time, the material was irrigated under running tap water for 48 hours to remove formaldehyde. Subsequently, the carcasses were dissected for accurate visualization of the blood vessels supplying the organs of the digestive system. Starting from the major arteries of the descending aorta, i.e. the celiac, cranial mesenteric, and caudal mesenteric arteries, all branches were meticulously traced, focusing on their final supply to individual organs from the proventriculus to the cloaca. All measurements included in the study were performed using callipers with an accuracy of 0.01 mm. Photographs were taken using a digital Nikon D320 camera and subsequently processed using Preview Version 11.0 (1056.2.4) image editing software, Copyright© 2002–2023 Apple Inc. (Apple, Cupertino, CA, USA). To ensure consistency and precision, the names of anatomical structures were standardized according to *Nomina Anatomica Avium* (Baumel et al., 1993).

RESULTS

The celiac artery of the common pheasant originated from the right, anterolateral aspect of the descending aorta, at the level of the third/fourth intervertebral disc of the thoracic segment (*discus intervertebralis*) and in the vicinity of the beginning of the proventriculus (**Fig. 1**).

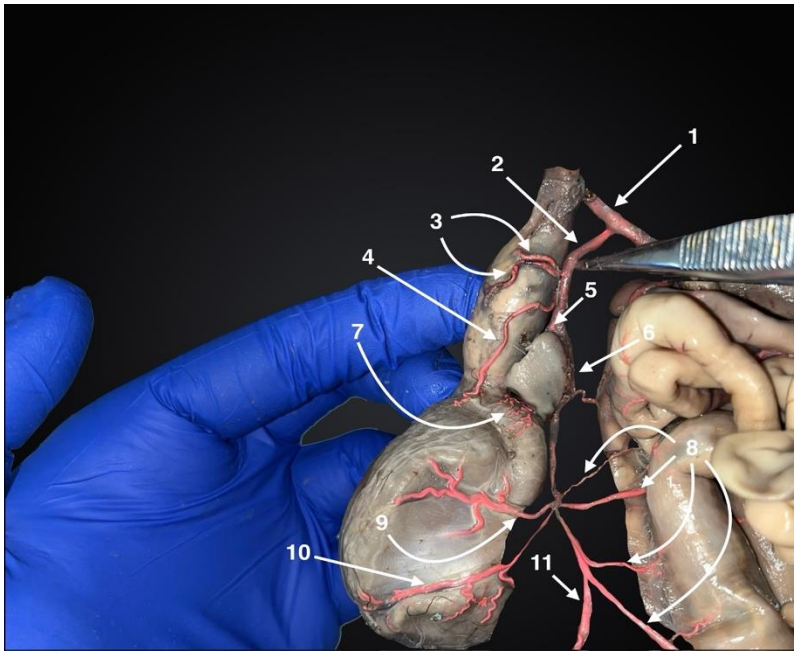

Fig. 1**.** 1. Descending thoracic aorta; 2. Celiac artery; 3. Dorsal proventricular artery; 4. Ventral proventricular artery; 5. Left branch of the celiac artery; 6. Right branch of the celiac artery; 7. Left gastric artery branches; 8. Iliocolic arteries; 9. Right dorsal gastric artery; 10. Right ventral gastric artery; 11. Pancreatic artery.

The celiac artery originated at the level of the third pair of ribs (*costae*). Its diameter at its origin averaged 1.7 mm. It coursed caudally, giving off branches supplying the oesophagus (*a. esophagealis*), proventriculus, gizzard, spleen, duodenum, beginning of the small intestine, and a portion of the large intestine. In all examined individuals, the celiac artery was seen to branch into the right and left branches after fully supplying the spleen at mid-length of the gizzard. The proventricular artery originated as the first direct branch from the main stem of the celiac artery, on average 11 mm from its beginning. In three cases, branching was observed as oesophageal branches (*rami esophageal*) directed towards the oesophagus, penetrating its terminal part. From the main part of the proventricular artery, three to four small terminal vessels branched off, penetrating the central part of the proventriculus. In one case, no branching was observed; the proventricular artery, as a single vessel, penetrated the middle part of the proventriculus. In three individuals, two separate main vessels were identified: the first gave off two branches into the central part of the proventriculus, while the second, much longer vessel, was directed towards the entrance of the gizzard, where it eventually divided into two branches. The ventral proventricular artery originated from the dorsal side of the left branch of the celiac artery, approximately 3 cm from the beginning of this vessel. Initially, it ran on the lateral-cranial side of the proventriculus as a single vessel, heading towards the gizzard. Eventually, it gave off two smaller branches: the right one penetrating the terminal part of

the proventriculus and the left one penetrating the initial part of the gizzard, giving off numerous small terminal branches. In three cases, an additional third branch penetrating the central part of the proventriculus was observed. All splenic arteries were shown to originate directly from the right branch of the celiac artery. Short branches, numbering from four to six, were identified as directly distributing blood to the spleen parenchyma, penetrating directly into its central part at approximately 1.2 mm intervals, extending along the entire length of the organ. In one case, one of the splenic arteries originated in the left branch of the celiac artery, with the caveat that in this particular individual, the spleen was located closer, a few millimetres before the primary branching.

The left branch of the celiac artery (Fig. 2) was shown to begin its course in the anterioabdominal direction, then to change direction towards the abdominal side of the body at the junction of the proventriculus with the gizzard.

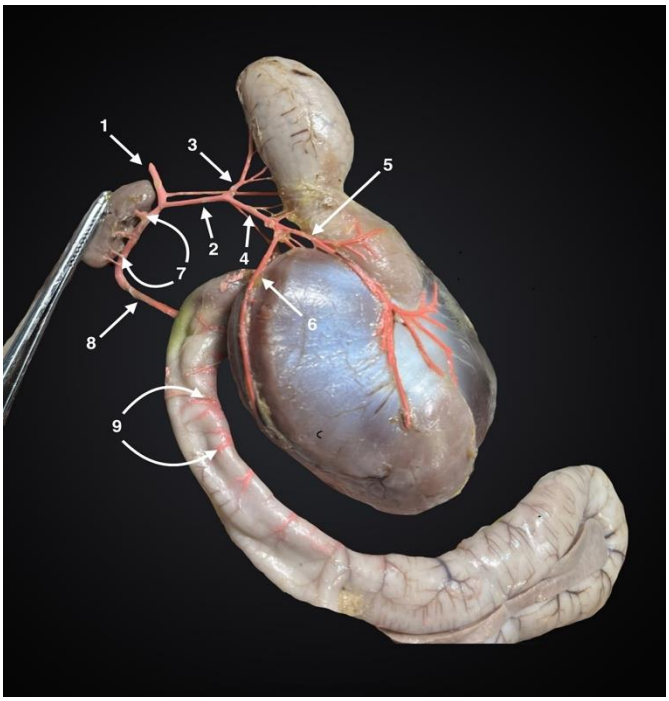

Fig. 2**.** 1. Celiac artery; 2. Left branch of the celiac artery; 3. Ventral proventricular artery; 4. Left gastric artery; 5. Left dorsal gastric artery; 6. Left ventral gastric artery; 7. Splenic arteries; 8. Right branch of the celiac artery; 9. Pancreatic artery branches

Along its course, the left branch of the celiac artery plays a crucial role in perfusion of the liver, giving off the left hepatic artery directed towards the central part of its left lobe. An artery supplying blood to the gallbladder branched off from this same branch. After these arteries, other important vessels also originated in the left branch of the celiac artery, such as the left gastric artery, which divided into ventral and dorsal gastric arteries. The direct continuation of the left branch of the celiac

artery was the left gastric artery, which extended along the cranial groove (*sulcus cranialis*) on the left side of the stomach. In four cases, it gave off 1–2 branches directed towards the entrance to the stomach. The left gastric artery then divided at the level of the *centrum tendineum* into three main branches: dorsal, middle, and ventral. The dorsal branch of the left gastric artery ran towards the dorsal part of the stomach. Along its course, it gave off lateral branches to the craniodorsal thin muscle (*musculus tenuis craniodorsalis*).

Meanwhile, the ventral and middle branches of the left gastric artery ran caudally, reaching the *centrum tendineum* area and extending into the caudal groove of the stomach (*sulcus caudalis*), supplying the surrounding musculature. Each of the above-described branches, along its entire length, gave off additional smaller vessels supplying a given region. In one case, anastomoses between the right and left gastric arteries were observed in the vicinity of the caudal groove of the stomach. The left hepatic artery originated in the left branch of the celiac artery, located in the ventrolateral region of the stomach. At the end of its course, it divided into two smaller branches that differed significantly in diameter. In 12 of the pheasants examined in the study, the left hepatic artery had a smaller diameter than its counterpart on the right side. In one case, the diameter of the left hepatic artery was larger. A multiple left hepatic artery formed by two smaller branches was observed in two birds.

The beginning of the right branch of the celiac artery was analogous to its left counterpart, branching off from the main trunk of the celiac artery opposite the left branch. It was significantly longer than the left branch, and it also had an extensive network of further vessels. The vessel ran in a caudal-abdominal direction, passing between the spleen and the right lobe of the liver and terminating near the duodenojejunal flexure, supplying this area. Along its course, the right branch of the celiac artery (Fig. 1) gave off several branches, including the splenic arteries, the right gastric artery, the right hepatic artery, the gastroduodenal arteries, and the pancreaticoduodenal artery. One of the first branches of the right branch of the celiac artery was the gastroduodenal artery. It started as a single vascular structure, giving off numerous smaller branches supplying the initial segment of the duodenum. Anatomically, this structure initially appeared relatively short, but after travelling an average of 4 millimetres, it underwent intense branching. It branched into many smaller vessels, ranging in number from six to eleven, broadly supplying the vicinity of the pylorus and the initial part of the duodenum.

The vessel originated directly from the right gastric artery in six specimens. It branched off, supplying blood to the craniodorsal thin muscle (*musculus tenuis craniodorsalis*), the cranioventral thick muscle (*musculus crassus cranioventralis*), the pyloric region, and the initial part of the descending portion of the duodenum. The right gastric artery originated as the next branch of the right hepatic artery and was located on average 14 mm from the caudal part of the spleen. In eight cases, its origin was directly opposite the first branch of the gastroduodenal artery.

In the majority of specimens, this artery initiated its course as the main vessel, which after travelling on average 3 mm from its origin, gave off two branches – the dorsocranial and ventrocaudal branches, forming a V-pattern and thus supplying the right part of the stomach. The dorsocranial branch was shown to give off a greater number of terminal branches, six on average, compared to the ventrocaudal branch, which gave off three such branches on average. In four cases, both of these branches originated directly from the right hepatic artery, initially the dorsal part and then the ventral

part, with no distinct gap between them, and thus not forming a common trunk. The next branch was the ileocolic artery, arising near the initial part of the duodenum.

The branches of this vessel departed at regular intervals of about 1.5 cm. These branches penetrated the distal third of the duodenum and a portion of the colon, directly giving off three main branches. The first two were relatively short and ended by bifurcating into two branches, which departed perpendicularly from the right branch of the hepatic artery and proceeded ventrally directly towards the large intestine. The third branch was usually thicker, and a greater number of smaller branches departed from it, which penetrated the nearer part of the large intestine and had a significantly wider supply area. This artery ran towards the supraduodenal loop (*ansa supraduodenalis*), where the distal branch of the ileocolic artery then gave off 4–6 jejunal branches, which ran in the mesentery between the caecum and the descending colon. These branches formed anastomoses with the intestinal arteries arising from the cranial mesenteric artery. The direct continuation of the right branch of hepatic artery was the pancreatoduodenal artery. It was located distally to the bifurcation of the ileocolic artery. The branches of this artery included vessels directed towards the pancreas and duodenum. Along its course, the vessel gave off pancreatic branches (*rr. pancreatici*) and duodenal branches (*rr. duodenales*), spread evenly along these structures. The artery extended to the level of the duodenal flexure (*flexura duodeni*), where it gave off symmetrical branches to both the ascending (*pars ascendens*) and descending (*pars descendens*) parts of the duodenum, providing comprehensive supply to these areas. While branching, the artery gave off from 18 to 24 larger branches, which distally divided into four terminal branches – two on each side of the intestine.

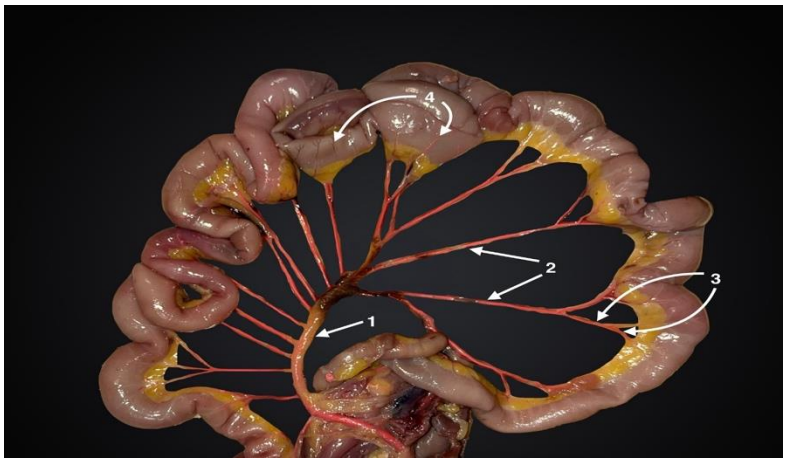

Fig. 3. 1. Cranial mesenteric artery; 2. Jejunal arteries; 3. Branches of the jejunal artery; 4. Long vessels of the jejunum

The cranial mesenteric artery (Fig. 3) was a single artery that initially appeared as a thick vessel and then narrowed as it approached the intestines. It originated from the descending abdominal aorta, which was the next branch after the inferior mesenteric artery at the level of the fourth thoracic

vertebra. It coursed through the mesenteric portion of the intestinal mesentery. Branches of this artery supply a broad spectrum of the gastrointestinal tract, excluding the stomach, parts of the duodenum, and sections of the colon. The cranial mesenteric artery gave off the following major branches:

- The duodenojejunal artery arose from the initial part of the cranial mesenteric artery, medially to the flexure of the duodenojejunal junction, and then directly divided into branches supplying the duodenum and jejunum. The duodenal branch supplied the proximal portion of the duodenum, including the initial part of the loop. The jejunal artery branch supplies the first 1/4 segment of the jejunum and anastomoses with the first jejunal arteries.
- The arteries of the jejunum (*aa. jejunales*) varied in number between 16 and 25 depending on the specimen. They were less numerous along the initial of the jejunum, ranging from 5 to 9, and the vessels originated at a distance from each other, on average every 4.5 mm. However, the frequency was higher in the further part of the intestine, and the distances between the vessels decreased on average to 2 mm. The arteries varied in length but had a similar diameter, supplying only the walls of the jejunum. They ran between the mesentery layers, and at successive segments of the intestine, they bifurcated into successive tiers. Initially, their number varied between 3 and 4, and from the final third of their length, the number of tiers decreased to 2 or 3. Ultimately, the branches all connected to form paraintestinal arterial arcades, from which branches emanated, encompassing the intestinal wall layers, secondarily dividing into short vessels (*vasa recta*) penetrating the intestinal wall directly from the mesentery side and long vessels (*vasa longa*) surrounding the duct, giving off anastomoses along the way, and ultimately ending on the opposite side.
- Arteries of the ileum (*aa. ilei*) numbered from 4 to 8, depending on the specimen, and were distally arising branches of the superior mesenteric artery. They supply the initial segment of the ileum.
- The ileocolic artery arose from the initial part of the cranial mesenteric artery. Branches further along this vessel supply the caecum and the terminal part of the ascending colon, anastomosing with branches of the right colic artery and then continuing distally, giving off short, direct vessels to the wall of the gastrointestinal tract.

The caudal mesenteric artery arose from the abdominal part of the descending aorta at the level of the terminal segment of the sacrum. Then, it proceeded ventrally, moving backwards towards the cloaca. At three-quarters of its length, it gave off two branches – the cranial and caudal branches, supplying the terminal portion of the large intestine and the cloaca. The cranial branch, which was longer than the caudal branch, ran anteriorly along the edge of the colon, supplying vessels to this part of the intestine, including branches of the ileum artery on both sides, thus providing blood to this segment of the gastrointestinal tract. The caudal branch, significantly shorter with a smaller lumen and fewer branching vessels, ran posteriorly along the edge of the rectal mesentery, ultimately giving off small rectal branches to the cloaca and the bursa of Fabricius.

Immediately after the departure of the caudal mesenteric artery, two similarly running pudendal arteries (*a. pudenda*) arose, branching off from the internal iliac artery with an average length of 4 cm. These arteries mainly supply the cloaca and its surrounding area, extending into the initial part of the coprodeum. The two arteries gave off the right cloacal artery (*a. cloacalis dextra*) and the left cloacal artery (*a. cloacalis sinistra*) at their ends. Then, in their final part, these vessels respectively

gave off much shorter and thinner branches, such as the cranial-dorsal and cranial-ventral branches, as well as the dorsal-lateral and dorsal-medial branches, which directly penetrated both the middle part (*urodeum*) and the terminal part (*proctodeum*) of the coprodeum.

DISCUSSION

The alimentary tract vasculature has been fully or partially investigated in some species of birds. These include the domestic goose (Baumel et al., 1993, Ragab et al., 2013, El Karmoty and Tolba, 2019), domestic turkey (Baumel et al., 1993, Naser and Khaleel, 2020), domestic chicken (Baumel et al., 1993, Kuru, 2010), duck (Scala et al., 1989, Baumel et al., 1993), domestic pigeon (*Columba livia domestica*), hooded crow (*Corvus corone*) (Noor, 2017, Hassan and El-Sayed, 2018), cattle egret (*Bubulcus ibis*) (Khalifa, 2014), greater flamingo (*Phoenicopterus roseus*) (Alan et al., 2016), long-legged buzzard (*Buteo rufinus*) (Haligur and Duzler, 2010), green-billed toucan (*Ramphastos dicolorus*) (Neto et al., 2013), ostrich (*Struthio camelus*) (Vasconcelos et al., 2012), and barn owl *(Tyto alba*) (Maher and Hussein, 2023). No studies were found in available sources regarding the arterial supply of the digestive system of the common pheasant.

Notably, most researchers focus on selected arteries, often limiting their analysis to the celiac artery while overlooking the mesenteric arteries. Our research provides a more comprehensive presentation of the vascularization of the pheasant's digestive system, considering all arteries supplying the proventriculus, ventriculus, liver, and small and large intestines.

The celiac artery, the cranial mesenteric artery, and the caudal mesenteric artery originate in the descending aorta. The celiac artery divides into two branches – right and left. Generally, our research findings align with those of Baumel et al., 1993; Kuru, 2010; Vasconcelos et al., 2012; Neto et al., 2013; Khalifa, 2014; Alan et al., 2016; El Karmoty and Tolba, 2019. In the pheasant, the celiac artery originates at the level of the second or third intervertebral disc of the thoracic vertebrae. In other birds, such as the hooded crow (Hassan and El-Sayed, 2018) and the heron (Khalifa, 2014), this artery arises from the fourth thoracic vertebra. In domestic birds, however, the celiac artery arises at the level of the fifth or sixth thoracic vertebra (Miladinovic et al., 1986; Franz and Salomon, 1993; Dursun, 2002). In flamingos, it originates at the level of the third or fourth thoracic vertebrae (Alan et al., 2016). Some authors refer to vertebrae without specifying whether the artery arises in the cranial or caudal region of a given vertebra.

There is no consensus among authors regarding the first branch of the celiac artery, even in the case of domestic birds. In the literature, publications on domestic birds, such as the works of authors like Kurtul and Haziroglu (2004) or Silva et al. (1997), claim that the first branch is the proventricular artery. Conversely, others, such as McLeod et al. (1964), Nickel et al. (1977), Baumel et al. (1993), and Kuru (2010), suggest that the oesophageal artery is the first branch. Both these views may be correct, and the presence of gastric arteries depends on individual characteristics. In our study, three pheasants had oesophageal arteries branching from the proventricular artery, while the rest had them branching directly from the celiac artery. Therefore, the first major artery branching from the celiac artery can be assumed to be the proventricular artery, with the possibility of additional oesophageal branches occurring earlier.

As mentioned above, the celiac artery divided into two branches – the right and the left. These findings are consistent with those of a significant proportion of authors, with the exception of Chiasson (1982) and Aycan and Duzler (2000). The blood supply to the spleen in the pheasant is

closely associated with the right branch of the celiac artery. Cralley (1965) notes that the common starling (*Sturnus vulgaris*) shows spleen supply directly from the trunk of the celiac artery. Additionally, some authors distinguish additional splenic arteries, but they were not observed in our study (Baumel et al., 1993). Furthermore, the right branch of the celiac artery subsequently gave off the right hepatic artery, the gastro-duodenal artery, gastric arteries, jejuno-ileal arteries, pancreatico-duodenal arteries, and the ileocolic artery.

The gastro-duodenal artery gave off numerous smaller branches that supplied the duodenal segment. In the pheasant, these are short vessels which, after travelling an average of 4 mm, bifurcate into 6–11 branches. The right gastric artery supplies the right part of the stomach. This artery exhibits significant variability among bird species. In the crow, according to a study by Hassan and El-Sayed from 2018, the gastric artery branches into three arteries: the ventromedial gastric artery, the dorsal gastric artery, and the ventral gastric artery. According to Alan et al. (2016), a similar division of arteries is observed in the flamingo and pheasant. In contrast, in the cattle egret, Khalifa (2014) noted the presence of 8–10 branches on the right side of the gastric artery.

Another significant branch is the left branch of the celiac artery. Alan et al. (2016) observed a narrowing of this branch compared to the right branch, while the branching pattern remains unchanged. In most cases, the diameter of the left hepatic branch in pheasants was smaller along its entire length than that reported by Haligur and Duzler (2010) in a study on red falcons. The left gastric artery of the domestic chicken also arises from the left branch of the celiac artery. Notably, two main unnamed branches of this artery were found in this species (Rezk and Bably, 2013); in our research, however, we found an additional third middle branch. Interestingly, in the common pheasant, the left gastric artery usually gives off three branches, dorsal, middle, and ventral, supplying various parts of the stomach, unlike the above-mentioned red falcon and domestic chicken, which showed a lack of a middle branch (Haligur and Duzler, 2010; Rezk and Bably, 2013; Alan et al., 2016).

Regarding the supply to the intestines, the main artery branching off from the thoracic aorta is the cranial mesenteric artery, which in the case of the hooded crow described by Hassan and El-Sayed (2018) branches at the level of the sixth thoracic vertebra, in contrast to the fourth thoracic vertebra in the pheasant. It is worth noting that no anastomosis with the pancreatic artery was found in our research; however, the pheasant showed analogous supply to the initial parts of the jejunum. In the pheasant, 16–25 branches from the mesenteric artery were found, as compared to 20 in the crow. In both the hooded crow and the domestic turkey (Naser and Khaleel, 2020), cranial branches of each intestinal artery were present, connecting with the caudal branch of the previous one to form arterial arcades. From these, many small branches arise, reaching the mesenteric edge of the jejunum. Such observations were made in the pheasant.

Regarding the arteries of the cloaca, no significant differences were found between species. A characteristic feature of the caudal mesenteric artery in the pheasant is that it is a single cranial branch, as in the domestic chicken (Khalifa and Ali, 2014), in contrast to the above-mentioned hooded crow and domestic turkey, which gives off several branches in the range of 4–6. The branching of caudal arteries in different bird species varies in number and branching patterns, typically with one or two. Despite these differences, the same arteries usually supply the cloacal region. However, there are differences in cloacal vascularization between pheasants, chickens, and turkeys. In pheasants, the terminal branches of the vaginal arteries supply blood to the cloaca,

whereas in chickens and turkeys, the cloacal arteries originate from the caudal mesenteric artery, numbering from 2 to 4, and then form anastomoses with the vaginal arteries, ultimately supplying the same area. No such anastomoses were observed in the present study.

CONCLUSION

The celiac artery of the pheasant originates from the right anterolateral part of the descending aorta. It gives off branches supplying the oesophagus, proventriculus, stomach, spleen, duodenum, and a segment of the large intestine. The first branch of the celiac artery was shown to be the proventricular artery. An important observation was that all splenic arteries originate directly from the right branch of the celiac artery. The right branch of the celiac artery has a longer course than the left branch. The right gastric artery gave off two main branches.

No additional splenic arteries were observed. The left branch of the mesenteric artery had a smaller diameter than the right branch. The ventral proventricular artery gave off three main branches. The caudal mesenteric artery did not anastomose with the pudendal arteries.

REFERENCES:

1. Alan A., Duzler A., Orhan I. (2016). Ramification of the celiac artery in the greater flamingo (*Phoenicopterus roseus*). Journal of the Faculty of Veterinary Medicine, 61: 97–101. DOI: 10.17221/8723-VETMED.
2. Aycan K., Duzler A. (2000). The anatomy of celiac artery in the eagle owl (*Bubo bubo*) (in Turkish). Journal of the Faculty of Veterinary Medicine, 47: 319-323.
3. Baumel J. J., King S. A., Breasile J. E., Evans H. E., Berge J. C. V. (1993) Nomina Anatomica Avium. Published by the Nuttall Ornithological Club. No: 23, Cambridge, Massachusetts, USA.
4. Chiasson R. B. (1982). Laboratory Anatomy of the Pigeon. Brown Company Publishers, Iowa.
5. Chiatante G., Meriggi A. (2022). Habitat selection and density of common pheasant *(Phasianus colchicus)* in Northern Italy: effects of land use cover and landscape configuration. European Journal of Wildlife Research, 68:26. DOI: 10.1007/s10344-022-01575-w.
6. Cralley J. C. (1965) The vascular anatomy of the starling (*Sturnus vulgaris*). Ph.D. Thesis. Anatomy, University of lllinois.
7. Dursun N. (2002). Anatomy of Domestic Birds (in Turkish). Ankara, Medisan Publishing, pp. 140-141.
8. El Karmoty A. F., Tolba A. R. (2019). Angioarchitectural Study on the Intrahepatic Blood Supply of Geese (*Anser Anser Domesticus*) with Special Reference to its Biliary System. Approaches Poult Dairy & Veterinary Sciences, 6:1-7.
9. Franz V., Salomon V. (1993). Lehrbuch der Geflügelanatomie. Gustav Fischer Verlag, Jena, Stuttgart.
10. Haligur A., Duzler A. (2010). Course and branch of the celiac artery in the red falcon (*Buteo rufinus*). Veterinární medicína, 55: 79–86. DOI: 10.17221/144/2009-VETMED.
11. Hassan S., El-Sayed A. K. (2018). Gross anatomy of the celiac, cranial mesenteric and caudal mesenteric arteries in Hooded Crow (*Corvus cornix*). Journal of Veterinary Anatomy, 11:41-55. DOI: 10.21608/jva.2018.44908.
12. Khalifa E. F., Ali S. A. M. (2014). The arterial blood supply of the intestinal tract of the domestic fowl (*Gallus gallus domesticus*). Suez Canal Veterinary Medical Journal, 19:155-165. DOI: 10.21608/scvmj.2014.65333.

13. Khalifa E. F. (2014). Gross anatomical studies on the celiac artery in cattle egret (*Bubulcus ibis*) with special reference to the arterial supply of the stomach. Journal of Veterinary Anatomy, 7: 1–13. DOI: 10.21608/jva.2014.44711.
14. Komarek V., Malinowsky L., & Lemez L. (1982). Anatomia ptaków domowych i embriologia kury [Anatomy and Embryology of the Domestic Birds]. PWRiL, Warszawa [in Polish].
15. Korbel R., Liebich H. G., Klupiec C. (2016). Avian anatomy: Textbook and colour atlas (Vol. 1). 5m Publishing, United Kingdom, Sheffield.
16. Kurtul I., Haziroglum R. M. (2004). Comparative macro-anatomical investigations on the pattern and branches of the descending aorta among the rooster, drake, and pigeon. Veterinary Journal of Ankara University, 51:1–6.
17. Kuru N. (2010). Macroanatomic investigations on the course and distribution of the celiac artery in domestic fowl (*Gallus gallus domesticus*). Scientific Research and Essays, 5:3585-3591.
18. Maher M. A., Hussein S. (2023). Anatomical distribution of celiac artery with histochemical investigation to the proventriculus of barn owl (*Tyto alba)*. Zoomorphology, 142:201-213. DOI: /10.1007/s00435-023-00595-7.
19. Mariyappan M., Rajendran M., Velu S., Johnson A. D., Dinesh G. K., Solaimuthu K., Kaliyappan M., Sankar M. (2023). Ecological role and ecosystem services of birds: a review. International Journal of Environment and Climate Change, 13:76-87. DOI: 10.9734/ijecc/2023/v13i61800.
20. McLeod W. M., Trotter D. M., Lumb J. W. (1964). Avian Anatomy. Minneapolis, Burgess Publishing Co. USA.
21. Miladinovic Z., Popoic S., Jojic D. (1986). Vascularization of the glandular stomach of the hen (*Gallus domesticus*). Acta Veterinaria, 5: 335-342.
22. Naser R., Khaleel I. M. (2020). The Arterial Vascularization of the Small and Large Intestine in Adult Male Turkeys (*Meleagris gallopavo*). The Iraqi Journal of Veterinary Medicine, 44:69-74. DOI: 10.30539/ijvm.v44i(E0).1024.
23. Neto O. J. S., Rosa M. C. B., Bonifacio T. M. M., Pinto A. B. F., Guimaraes C. S. O., Guimaraes G. C. (2013). Origin, ramification and distribution of the celiac artery in green-billed toucan (*Ramphastos dicolorus*). (in Portuguese). Pesquisa Veterinária Brasileira, 33:399–404. DOI: 10.1590/S0100-736X2013000300021.
24. Nickel R., Schummer A., Seiferle E. (1977). Anatomy of the Domestic Birds. Verlag Paul Parey, Berlin.
25. Noor N. A. (2017). Macroanatomic investigations on the course and distribution of the celiac artery in Hooded crow (*Corvus cornix*) with special reference to the arterial supply of the stomach. Journal of Veterinary Medical Research, 24(2): 222-234. DOI: 10.21608/jvmr.2017.43286.
26. Ragab S. A., Farag F. M. M., Tolba A. R., Saleh A. A., El-Karmoty A. F. (2013). Anatomical Study on the Celiac Artery in the Domestic Goose (*Anser anser domesticus*) with Special Reference to the Arterial Supply of the Stomach. Journal of Veterinary Anatomy, 6:23-40. DOI: 10.21608/jva.2013.45021
27. Rezk H., Bably S. M. (2013). Gross Anatomical Studies on the Celiac Artery in The Domestic Fowl (*Gallus gallus domesticus*). Journal of Veterinary Anatomy, 7:127-141. DOI: 10.21608/jva.2014.44721.

28. Riley T. Z., Schulz J. H. (2001). Predation and ring-necked pheasant population dynamics. Wildlife Society Bulletin, 29:33-38.
29. Scala G., Caputo G., Paino G., Pelagalli G. V. (1989). The vascularization of the bursa cloacalis (of Fabricius) in the duck. Anatomia, Histologia, Embryologia, 18:66-75. DOI: 10.1111/j.1439-0264.1989.tb00582.x.
30. Schöll E. M., Eschberger-Friedl A., Schai-Braun S., Frey-Roos A. (2023). Habitat preferences and similarities of Grey Partridges and Common Pheasants in agricultural landscapes under organic and conventional farming. European Journal of Wildlife Research, 69:29. DOI: 10.1007/s10344-023-01659-1.
31. Silva Carneiro F. O., Severino R. S., Santos A. L. Q., Drummond S. S., Bombonato P. P., Santana M. I. S., Lopes D., Marçal A. V. (1997). Origin and distribution of the celiac artery in birds (*Gallus gallus domesticus* - Ross lineage). Revista da Faculdade de Zootecnia, Veterinaria e Agronomia (Brazil), 4: 35-41 [in Portuguese].
32. Vasconcelos B. G., Silva F. O. C., Miranda R. L., Pereira C. C. H., Santos A. C., Miglino M. A. (2012). Origin and distribution of the celiac artery in ostrich (*Struthio camelus*) (in Portuguese). Ciência Animal Brasileira, 13:108–114. DOI: 10.5216/cab.v13i1.15520.