

*The arterial blood supply of the intestinal tract of the domestic fowl  
(Gallus gallus domesticus)*

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**Abstract**

The aim of this study was to investigate the arterial blood supply of the intestinal tract of fowl. Ten apparently healthy chicken (Balady breed) of both sexes were used in the study. The specimens were injected with red colored latex through the descending aorta. The origin, branching pattern and distribution of the different arteries supplying the small and large intestines were documented. The intestinal tract of fowl received its arterial supply through four main sources namely; the right branch of the celiac artery, the cranial mesenteric, the caudal mesenteric and the internal iliac arteries. The right branch of the celiac artery was contributed to the duodenum, pancreas, last third of ileum and left cecum. The cranial mesenteric artery supplied the terminal portion of duodenum, jejunum, cranial two thirds of ileum, right cecum and cranial portion of colon. The caudal mesenteric artery supplied the rectum and the cranial portion of cloaca. The internal iliac artery supplied the caudal portion of cloaca and cloacal bursa.

**Key words:** *Arterial supply - Intestinal tract - Fowl.*

**Introduction**

Fowl is one of the major sources for meat and egg production, and still the cheapest source of animal protein with high biological value for people all over the world. The importance of the fowl among our native livestock has initiated an increasing interest to establish more accurate and specific anatomical facts about the arterial blood supply of the intestine of the fowl. The distribution of the cranial and caudal mesenteric arteries to the

intestinal tract was described by *Campos et al (2006)* and *Santana et al (2001)* in the fowl and *Pinto et al (1998)* in the duck. The available literature on arterial blood supply of the intestine of the fowl doesn't provide complete detailed information about the scope of the work. So, the present study aimed to declare this confusion about the course and distribution of the arterial blood supply of the intestinal tract of the domestic fowl

which may be helpful for clinical and experimental purposes.

### Material and methods

The current study was conducted on ten adult, apparently healthy chicken (Balady breed) of both sexes, weighing about 1.5-2 kg; obtained from the chicken farms around Cairo governorate. Before exsanguinations, birds were anaesthetized by IM injection of 0.5 cc of 2% xylazine HCL (3 mg/kg) to provide relaxation and prevent vasoconstriction, followed by the injection of heparin (**Cal Heparin, 5000 I.U.**) in the wing vein to prevent blood clotting. Each specimen was exsanguinated through the common carotid arteries and left to bleed for five minutes. The breast muscles and sternum were carefully removed to expose the heart. A Nelaton catheter of size 6F to 8F (*Ma Medical Company*) was introduced into the descending aorta and legated using cotton thread to prevent leakage. The injection mass comprised of 60% of latex neoprene colored red using **Rottring ink**. The specimens were then kept at +4°C for 24 hours to ensure the freezing of latex and then preserved in 10% formalin 4% phenol and 1% glycerin for three days before dissection. The specimens were photographed using Olympus digital camera **SP-600UZ** 12 mega pixel. The nomenclature used in this study was that given by the *Nomina Anatomica Avium* (*Baumel et al, 1993*).

### Results

The intestinal tract of the fowl received its arterial supply through four main sources namely; the right branch of the celiac artery, the cranial mesenteric, the caudal mesenteric and the internal iliac arteries.

#### **I- Ramus dexter arteriae celiacae:**

The right branch of the celiac artery (Fig. 1 and 5/3) was detached from the right aspect of the celiac artery (Fig. 1, 4 and 5/2) between the spleen and the right lobe of the liver. It gave off the splenic, right hepatic, gastroduodenal and right gastric arteries and then continued as pancreaticoduodenal artery. The branches of the right branch of the celiac artery that contributed to the blood supply of the duodenum represented; A. gastroduodenalis and A. pancreaticoduodenalis.

#### **A. gastroduodenalis:**

The gastroduodenal artery (Fig.1/4) was represented by a short stem vessel that erupted as one of the terminal branches of the right branch of the celiac artery. It soon divided into three to four small rami that distributed to the pylorus and craniodorsal tenius muscle of the muscular stomach as well as to the proximal region of the descending limb of the duodenum.

#### **A. pancreaticoduodenalis:**

The pancreaticoduodenal artery (Fig.1/5) was the direct continuation of the right branch of the celiac artery after the origin of the right gastric artery. It proceeded along

the mesodudenum between the descending and ascending limbs of the duodenum where it gave off Rr. pancreatici and Rr. duodenales (Fig.1/6). These rami were arisen at different levels and dispersed to the corresponding organs. It also detached the ileocecal arteries (Fig.1 and 5/7).

#### **Aa. ileocecales:**

The ileocecal arteries (Fig.1 and 5/7) were 2-3 branches, detached at intervals from the first third of the pancreaticoduodenal artery. These branches entered the short ileocecal ligament and distributed to the last third of the ileum and the left cecum.

#### **II- A. mesenterica cranialis:**

The cranial mesenteric artery (Fig.1, 2, 4 and 5/8) originated from the descending aorta (Fig.1, 2, 4 and 5/1) about 1.2 cm. caudal to the origin of the celiac artery on a level with the last rib. It proceeded caudoventrally in the mesentery forming a semicircular curve that ended near the mesentery of the ileum. Along its course, the cranial mesenteric artery released ileocecal, duodenojejunal, jejunal and ileal arteries.

#### **A. ileocecalis:**

The ileocecal artery (Fig.2, 4 and 5/9) was represented by a short vessel arising from the cranial mesenteric artery near its commencement. It gave off the colic branch (Fig.2, 4 and 5/10) that passed in a caudal direction giving 4-5 branches distributed to the cranial portion of the colon. An

anastomosis (Fig. 4 and 5/11) was found between this colic branch and the cranial branch of the caudal mesenteric artery. Then the ileocecal artery proceeded cranially in the mesocolon where it terminated into 3-4 branches (Fig. 4 and 5/9a) to supply the cranial two thirds of the ileum and right cecum.

#### **A. duodenojejunalis:**

The duodenojejunal artery (Fig.2/12) was relatively large vessel that arose from the cranial mesenteric artery and ramified to the duodenojejunal flexure by duodenal branch (Fig.2/12a) and the beginning of the jejunum by jejunal branch (Fig.2/12b).

#### **Aa. Jejunales:**

The jejunal arteries (Fig.2/13) constituted 6-11 vessels that arose from the convex aspect of the cranial mesenteric artery at short intervals and extended in the mesojejunum to the mesenteric border of the jejunum. On reaching the latter border each jejunal artery was divided into two branches that anastomosed with the corresponding branches of the adjacent arteries forming the intestinal arches (Fig.2/14). From these arches fine numerous collateral twigs were detached which supplied both sides of the jejunal wall.

#### **Aa. ileales:**

The ileal arteries (Fig.2/15) represented by 2-3 branches originated from the terminal portion of the cranial mesenteric artery, they proceeded dorsally then each

bifurcated into two branches. These vessels were distributed into the proximal portion of the ileum as well as the expanded blind ends of the intestinal ceca and anastomosed with the ileocecal artery.

### **III- A. mesentrica caudalis:**

The caudal mesenteric artery (Fig.3, 4 and 5/16) was given off from the descending aorta (just caudal to the caudal lobe of the kidney) as short stem vessel about 1.2 cm. in length which soon divided into cranial and caudal branches.

The cranial branch of the caudal mesenteric artery (Fig.3, 4 and 5/17) passed cranially alongside the dorsal wall of the colon. It divided into large cranial and small caudal rami. The large cranial ramus (Fig.3 and 4/19) passed cranially to anastomose with the colic branch of the ileocecal artery. Along its course, it released 4-6 twigs supplying the cranial portion of the colon, while the small caudal ramus (Fig.3 and 4/20) supplied the caudal

portion of the colon through 2-3 twigs.

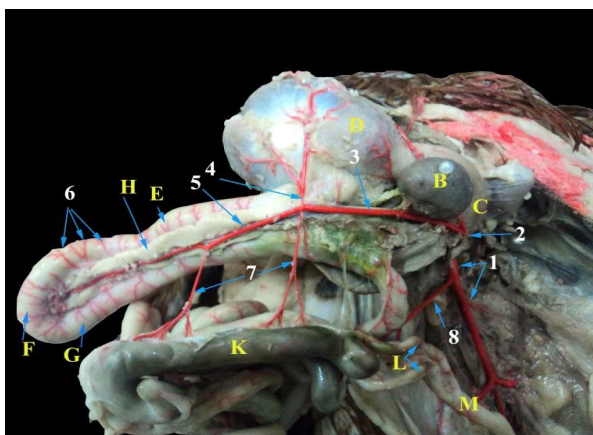
The caudal branch of the caudal mesenteric artery (Fig.3, 4 and 5/18) extended caudally on the dorsal aspect of the colon and gave off 3-5 colic branches (Fig.3/21) that distributed to the caudal portion of the colon and 2-4 cloacal branches (Fig.3/22) that ramified in the cranial portion of the cloaca and anastomosed with the cloacal branches of the internal pudendal artery.

### **IV- Aa.iliaca interna:**

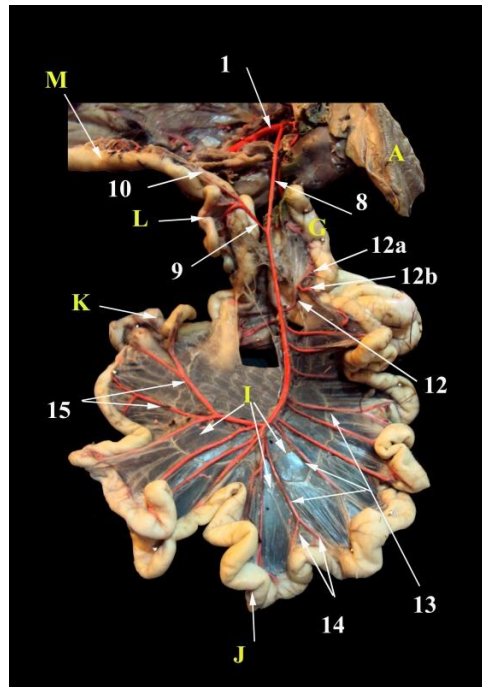
The internal iliac arteries (Fig.3, 4 and 5/23) originated by the bifurcation of the descending aorta on a level with the 6<sup>th</sup> synsacral segment. In between the latter two vessels arose the median caudal artery (Fig.3 and 4/24). The internal iliac artery extended caudolaterally for about 1.8 cm. and gave off the internal pudendal artery (Fig.3, 4 and 5/25) which gave three large cloacal branches (Fig.3, 4 and 5/26) that ramified in the caudal portion of the cloaca and cloacal bursa.

**Table (1):** Showing the arteries supplying the intestinal tract of fowl, their origin and area of distribution.

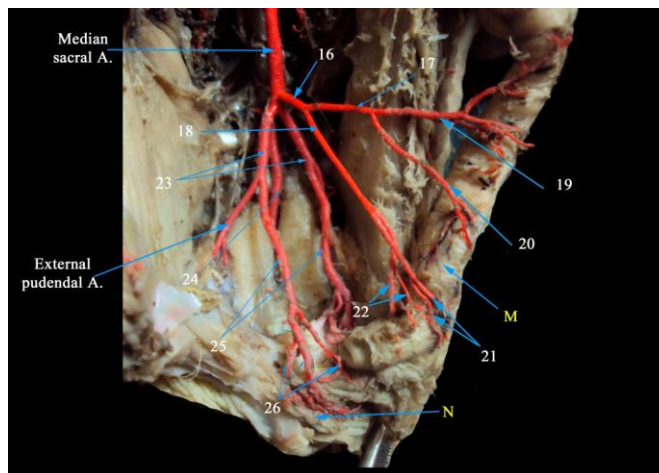
Artery	Origin	Distribution
1- Gastroduodenal artery	Right branch of celiac artery	1- Pylorus. 2- Craniodorsal tenuis muscle. 3- Proximal region of the descending limb of duodenum
2- Pancreaticoduodenal artery	Right branch of celiac artery	1- Duodenum 2- Pancreas
3- Ileocecal arteries	Pancreaticoduodenal artery	1- Last third of the ileum and the left cecum
4- Ileocecal artery	Cranial mesenteric artery	1- Cranial two thirds of the ileum and right cecum.
5- Colic branch of ileocecal of cranial mesenteric artery	Ileocecal artery	1- Cranial portion of the colon
6- Duodenojejunal artery	Cranial mesenteric artery	1- Beginning of the jejunum 2- Duodenojejunal flexure
7- Jejunal arteries (6-11)	Cranial mesenteric artery	1- Jejunum
8- Ileal arteries	Cranial mesenteric artery	1- Proximal portion of the ileum 2- Blind ends of the intestinal ceca (apex)
9- Cranial branch of caudal mesenteric artery	Caudal mesenteric artery	1- Cranial portion of the colon 2- Caudal portion of the colon
10- Caudal branch of caudal mesenteric artery	Caudal mesenteric artery	1- Caudal portion of the colon 2- Cranial portion of the cloaca
11- Cloacal branches of internal iliac artery	Internal iliac artery	1- Caudal portion of the cloaca and cloacal bursa



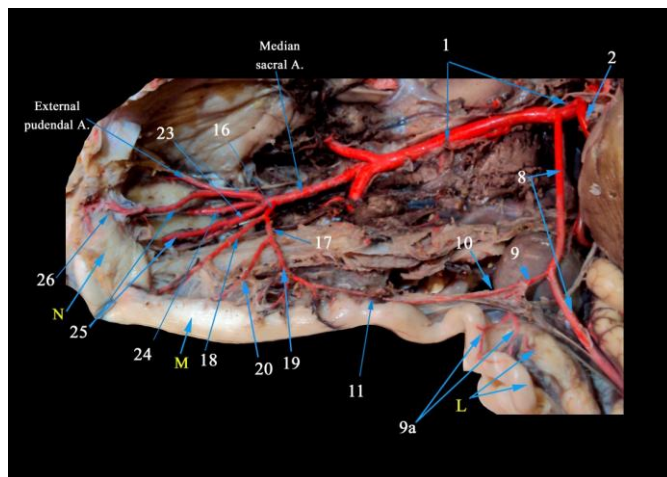
**Fig. (1):** A photograph showing the branches of the right branch of the celiac artery of the fowl



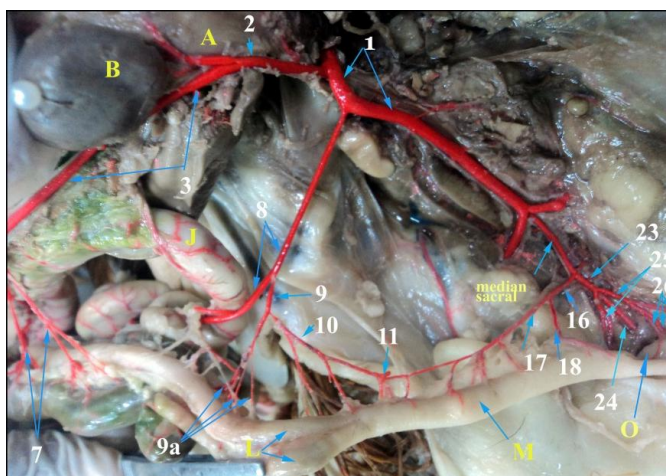
**Fig. (2):** A photograph showing the branches of the cranial mesenteric artery of the fowl



**Fig. (3):** A photograph showing the branches of the caudal mesenteric artery of the fowl



**Fig. (4):** A photograph showing the branches of the caudal mesenteric and internal iliac arteries of the fowl



**Fig. (5):** A photograph showing the origin of the different arteries supplying the intestinal tract of the fowl

**Legend for the figures from 1-5**

- 1-Aorta descendens  
 2-A.celiaca  
 3-R. dexter arteriae celiacae of 2  
 4- A. gastroduodenalis of 3  
 5- A. pancreaticoduodenalis of 3  
 6- Rr.duodenales of 5  
 7- Aa.ileocecales of 5  
 8-A.mesenterica cranialis  
 9-A.ileoecalis of 8  
 9a -Rr.collaterales of 9  
 10-R.colicus of 9  
 11- R. anastomotica et 10 and 17  
 12- A.duodenojejunalis of 8  
 12a- R.duodenalis of 12  
 12b- R.Jejunalis of 12  
 13-Aa. Jejunales  
 14-Arcus intestinalis  
 15-Aa.ileales  
 16- A.mesentrica caudalis  
 17-R.cranialis of 16  
 18- R.caudalis of 16  
 19- R.cranialis of 17  
 20- R.caudalis of 17  
 21-Rr.colica of 18  
 22-Rr.cloacales of 18  
 23-A.iliaca interna  
 24-A.caudalis mediana  
 25-A.pudenda interna  
 26-Rr.cloacales of 25  
 A- Liver  
 B- Spleen(Lien)  
 C- Proventriculus  
 D- Ventriculus (Gizzard)  
 E-Pars descendens duodeni  
 F-Flexura duodeni  
 G-Pars ascendens duodeni  
 H- Pancreas  
 I-Mesojejenum  
 J-Jejunum  
 K-Ileum  
 L-Cecum  
 M- Rectum(Colon)  
 N- Cloaca  
 O- Cloacal bursa

**Discussion**

In agreement with *Farag et al., (2013)* in turkey and *Haligu and Duzler (2010)* in red falcon, the right branch of the celiac artery contributed to the blood supply of the intestinal tract through the gastroduodenal and pancreaticoduodenal arteries. *Kuru (2010)* in the domestic fowl revealed that the gastroduodenal artery was a short vessel, originating from the right branch of the celiac artery and was distributed to the pylorus and craniodorsal tenuis muscle. The same observations were confirmed in the

present study in addition to the gastroduodenal artery was also distributed to the proximal region of the descending limb of the duodenum.

The present study as well as *Farag et al (2013)* in turkey and *Pinto et al., (1998)* in domestic duck revealed that the pancreaticoduodenal artery was the direct continuation of the right branch of the celiac artery after the origin of the right gastric artery. On the other hand *Baumel (1975), Franz and Salomon (1993)* and *Malinovsky and Novotna (1977)* in the fowl considered the



duodenojejunal artery as the direct continuation of the right branch of the celiac artery between the ascending and descending part of the duodenum.

The current investigation revealed that the cranial mesenteric artery detached from the descending aorta caudal to the origin of the celiac artery, the same as mentioned by *El karmoty (2014)* in ducks and geese, *Farag et al (2013)* in turkey, *Nickel et al (1977)* and *Campos et al (2006)* in the fowl and *Pinto et al (1998)* in the domestic duck. In fowl, the cranial mesenteric artery gave off the ileocecal, duodenojejunal, jejunal and ileal arteries. *Nickel et al (1977)* in fowl reported that the first vessel arising from cranial mesenteric artery was the A. ileocecalis then continued as the truncus jejunalis from which numerous vessels, the rami jejunales, were detached. *Pinto et al (1998)* in the domestic duck mentioned that the cranial mesenteric artery divided into three main branches. The first branch supplied the colon and rectum, forming an anastomosis with the caudal mesenteric artery. The second branch gave the jejunal arteries and finally the third one was distributed into the final portion of the right cecum and ileum.

Regarding the number of jejunal and ileal arteries that detached from cranial mesenteric artery in our study there are, 6 - 11 jejunal and 2 - 3 ileal arteries. On the other hand, *Farag et al (2013)* in turkey,

mentioned 10-14 jejunal and 4-6 ileal arteries. *Pinto et al (1998)* in the domestic duck, recorded 8-20 jejunal arteries and *Cardoso et al (2002)* in bumpkin chicken, observed 4-11 jejunal and 5-13 ileal arteries. It is to add that the marginal artery reported by *Baumel (1986)* in fowl that formed by the anastomosis of the terminal branches of the jejunal and ileal arteries along the antimesenteric border could be ascertained in the present study.

The current investigation revealed the origin of the colic branch was detached from the ileocecal artery of the cranial mesenteric artery. This branch passed in a caudal direction giving 4-5 rami that distributed into the cranial portion of the colon and it anastomosed with the cranial branch of the caudal mesenteric artery. The latter colic branch was not recorded in any of the available literatures. *Ebada et al (2006)* in the ostrich observed a proper colic artery arising from the cranial mesenteric artery and divided into an ascending and a descending branch. However, the proper colic artery could be matched with the ileocecal artery that mentioned in the present study. Concerning the pattern followed by the caudal mesenteric artery, we observed that it was originated from the aorta as a single vessel, next to the caudal lobe of the kidneys. In all observed samples the caudal mesenteric artery was divided into two branches cranial and caudal.

Similar findings were recorded by *El karmoty (2014)* in ducks and geese, *Farag et al (2013)* in turkey, *Pinto et al (1998)* in the domestic duck and *Santana et al (2001)* and *Campos et al (2006)* in the fowl. On the other hand, *Ebada et al (2006)* in the ostrich mentioned that the caudal mesenteric artery gave off 10-12 long branches and added that each of these branches provided four subdivisions before reaching the mesenteric border of the colon.

The anastomosis between the cranial and caudal mesenteric arteries was established through the ileocecal artery in the present study; while *Farag et al (2013)* in turkey recorded this anastomosis between the cranial and caudal mesenteric arteries through the colic branch of the former and the cranial branch of the latter one. On the other hand, *Pinto et al (1998)* in the domestic duck recorded that the caudal mesenteric artery anastomosed with one of the three main branches arising from the cranial mesenteric artery.

In fowl the internal pudendal artery was given from the internal iliac artery. On the contrary, *Nickel et al (1977)* in the fowl described it as paired vessel arising directly from the aorta immediately caudal to the origin of the caudal mesenteric artery. The present study also recorded cloacal branches arose from the internal pudendal artery that ramified into the caudal portion of the cloaca and cloacal bursa.

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## المخلص المدد الشرياني للسبيل المعوى فى الدجاج

السيد فتح خليفة - صفوت أحمد علي\*  
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أجري البحث على المدد الشرياني للسبيل المعوى فى عشر من الدجاج صحيحة ناضجة سلالة بلدي من الجنسين وتزن الواحدة ما بين ١,٥-٢ كيلوجرام لأجل الدراسة التشريحية. عولجت العينات التي إستخدمت للدراسة التشريحية، بعد ذبحها وإستنزافها للتخلص من بقايا الدم فى أوعيتها الدموية ثم حقنها بالوسائل الروتينية بمحلول اللاتكس نيوبرين (السائل المطاطى اللينى) الملون باللون الأحمر ثم حفظت فى خليط من الفورمالين ١٠% الفينول ٤% والجليسرين ١% وتم تشريحها بدقة بعد ثلاثة أيام. وقد تبين من الدراسة ان المدد الشرياني للسبيل المعوى فى الدجاج يتم عن طريق اربعة شرايين وهى: الفرع الأيمن للشريان الجوفى والشريان المساريقى الدماغى والشريان المساريقى الذيلى والشريان الحرقفى الداخلى. وقد تم وصف منشأ ومسار وتوزيع هذه الشرايين بالسبيل المعوى بدقة وتم إعتقاد المسميات واستخدام المصطلحات التشريحية البيطرية الدولية للطيور لسنة ١٩٩٣ فى تسمية الشرايين. وقد تم تزويد الدراسة بخمس صور للعينات بعد تشريحها، وذلك لتوضيح النتائج. كما نوقشت النتائج المتاحة فى الدراسة مع ما تم الحصول عليه فى الاعمال السابقة فى الطيور المستأنسة.