

Comparison of Biometric Characters of Aorta Branches in Farm and Wild Fox (*Vulpes vulpes* L.)

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The study involved 147 fox (*Vulpes vulpes* L.) individuals; 74 individuals of red fox (wild form) and 73 individuals of silver fox (farm fox). In which, in most cases, descend in a direct line from *Vulpes vulpes* L. of the East Canadian subspecies (*Vulpes vulpes fulva* Dessm.) Synthetic latex was introduced via left ventricle into the specimens. The material was fixed for 8-10 weeks with a 5% formalin solution, which was followed by the preparation of arteries of the aortic arch and descending aorta and then measurement-taking. Comparative studies showed differences in the aorta morphometric arrangement between wild fox and farm silver fox.

Key words: Fox, arteries, aorta.

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Fox (*Vulpes vulpes* L.) is the most common representative of the Carnivora family in Poland and, at the same time, as reported by JAROSZ (1993), it has been bred since 1926 also on farms.

A change in the way of life of animals may be reflected in their anatomy. According to WILAND (1974), e.g. differences can be shown in the anatomy and pattern of arteries. Similar variation may be observed for other morphological structures.

The anatomy of aorta branches in fox (*Vulpes vulpes* L.) described in literature was reported by KNASIECKA (1987), WILAND *et al.* (1996), concerning the branches of aortic arch, and by BRUDNICKI *et al.* (1986) and KNASIECKA (1986a, 1986b), describing the abdominal aorta or its branches. There are no reports available which would cover the morphometric variation in this group of animals.

Material and Methods

The study involved 147 fox (*Vulpes vulpes* L.) individuals; 74 red fox individuals (wild fox) and 73 silver fox individuals (farm fox) which, in most cases, descend in a direct line from *Vulpes vulpes* L. of the East Canadian subspecies (*Vulpes vulpes fulva* Dessm.). Synthetic latex was introduced via the left ventricle, using a syringe. The material was

fixed for 8-10 weeks with a 5% formalin solution, which was followed by artery preparation. The measurements of the diameter of the vessels descending from the aorta were taken 1mm over the places of their descent. The places of measurements are given in Figure 1. The anatomic nomenclature in this paper is used following PILARSKI (1978).

Results and Discussion

The aorta measurements, i.e. the total length, thoracic aorta length, and the diameters of the aortic arch and abdominal aorta, are presented in Table 1.

The analysis of measurements of aortic arch branches showed highly significant differences between wild fox and farm fox. The greatest differences concerned the diameters of common carotid arteries.

The biometric characters of the parameters of the abdominal aorta showed considerably greater variation than the aortic arch branches. The mean values of the length of the celiac trunk, cranial mesenteric artery, diameter of left and right deep circumflex iliac arteries were greater in silver fox than in red fox (Table 2).

Table 1

Breakdown of measurements of the aorta in red and silver fox

Character	Group	Interval	Mean	S _d	V _x	t _o
Total length of aorta (cm)	Red fox	21.50-30.00	24.75	1.475	5.96	2.072*
	Silver fox	20.00-29.00	24.14	1.996	8.27	
Length of thoracic aorta (cm)	Red fox	13.00-18.00	14.87	1.096	7.37	4.427***
	Silver fox	9.00-17.50	13.90	1.512	10.88	
Diameter of aortic arch (mm)	Red fox	8.26-11.27	9.65	0.708	7.34	9.462***
	Silver fox	7.01-10.25	8.57	0.662	7.72	
Diameter of abdominal aorta (mm)	Red fox	5.13-8.12	6.41	0.642	10.02	10.290***
	Silver fox	3.94-6.86	5.46	0.456	8.35	

Level of significance for: P 0.05 (*) – significant; P 0.01(**) – highly significant; P 0.001 (***) – very highly significant.

Table 2

Biometric parameters of aortic arch branches in red and silver fox

Character (mm)	Group	Interval (mm)	Mean	S _d	V _x	t _o
Diameter of brachiocephalic trunk	Red fox	3.65-6.23	4.66	0.495	10.62	2.859**
	Silver fox	2.95-5.82	4.37	0.711	16.27	
Diameter of right common carotid artery	Red fox	2.00-3.29	2.60	0.305	11.73	9.777***
	Silver fox	1.27-2.69	2.04	0.377	18.48	
Diameter of left common carotid artery	Red fox	2.06-3.42	2.60	0.300	11.54	9.039***
	Silver fox	1.30-2.95	2.10	0.366	17.43	
Diameter of right internal thoracic artery	Red fox	1.38-2.62	1.90	0.308	16.21	5.244***
	Silver fox	0.60-2.35	1.63	0.318	19.51	
Diameter of right vertebral artery	Red fox	1.21-2.77	1.90	0.287	15.11	8.582***
	Silver fox	0.79-2.05	1.49	0.287	19.26	
Diameter of right costocervical trunk	Red fox	1.09-2.70	1.92	0.311	16.20	4.706***
	Silver fox	0.66-2.47	1.65	0.374	22.67	
Diameter of right superficial cervical artery	Red fox	1.05-2.36	1.46	0.228	15.62	4.414***
	Silver fox	0.70-1.71	1.29	0.217	16.82	
Diameter of left subclavian artery	Red fox	2.39-4.96	3.44	0.469	13.63	3.678***
	Silver fox	1.98-4.08	3.15	0.495	15.71	
Diameter of left internal thoracic artery	Red fox	1.28-2.69	1.90	0.254	13.37	7.520***
	Silver fox	0.90-2.08	1.56	0.283	18.14	
Diameter of left vertebral artery	Red fox	1.27-2.69	1.81	0.299	16.52	6.859***
	Silver fox	0.56-2.07	1.47	0.300	20.41	
Diameter of left costocervical trunk	Red fox	1.42-2.84	1.97	0.305	15.48	6.216***
	Silver fox	0.85-2.13	1.63	0.355	21.78	
Diameter of left superficial cervical artery	Red fox	0.86-2.09	1.44	0.219	15.21	4.045***
	Silver fox	0.76-1.66	1.29	0.205	15.89	

Level of significance for: P 0.05 (*) – significant; P 0.01(**) – highly significant; P 0.001 (***) – very highly significant

The differences in the measurements of the diameters of the left renal artery and left phrenoabdominal artery, and the diameter of the right renal artery were non-significant. Similarly, non-significant

values were obtained for the differences in the diameter of the aorta below the descent of the external iliac arteries and the median caudal artery (Table 3).

Table 3

Biometric parameters of abdominal aorta in red and silver fox

Character	Group	Interval (mm)	Mean	S _d	V _x (%)	t ₀
Diameter of coeliac trunk	Red fox	2.03-3.96	3.01	0.402	13.35	4.769***
	Silver fox	1.16-3.90	2.62	0.573	21.87	
Diameter of common hepatic artery	Red fox	1.30-2.55	1.87	0.278	14.87	4.217***
	Silver fox	0.78-2.53	1.63	0.397	24.35	
Diameter of left gastric artery	Red fox	1.01-2.29	1.70	0.268	15.76	6.115***
	Silver fox	0.57-2.53	1.36	0.383	28.16	
Diameter of splenic artery	Red fox	1.56-2.80	2.21	0.315	14.25	9.487***
	Silver fox	0.68-2.81	1.67	0.366	21.92	
Diameter of cranial mesenteric artery	Red fox	2.24-5.30	3.56	0.520	14.61	2.487*
	Silver fox	1.01-6.98	3.25	0.941	28.95	
Diameter of left phrenoabdominal artery	Red fox	1.07-2.07	1.54	0.238	15.47	0.387
	Silver fox	0.28-2.12	1.51	0.623	41.26	
Diameter of left renal artery	Red fox	1.97-4.40	2.71	0.464	17.12	-1.116
	Silver fox	1.32-4.20	2.82	0.642	22.76	
Diameter of right renal artery	Red fox	2.05-4.47	3.05	0.534	17.51	1.772
	Silver fox	1.46-4.33	2.87	0.704	24.53	
Diameter of right phrenoabdominal arter	Red fox	0.83-1.94	1.34	0.219	16.34	2.020*
	Silver fox	0.66-2.26	1.25	0.295	23.60	
Diameter of caudal mesenteric artery	Red fox	1.07-1.95	1.49	0.178	11.95	2.894**
	Silver fox	0.70-2.13	1.38	0.279	20.22	
Diameter of left deep circumflex iliac artery	Red fox	0.89-1.83	1.20	0.179	14.92	-6.040***
	Silver fox	0.62-2.18	1.46	0.317	21.71	
Diameter of right deep circumflex iliac artery	Red fox	0.72-1.60	1.18	0.167	14.15	-3.234**
	Silver fox	0.65-1.79	1.31	0.304	23.21	
Diameter of left external iliac artery	Red fox	2.24-3.51	2.93	0.326	11.13	4.344***
	Silver fox	1.55-3.34	2.70	0.303	11.22	
Diameter of right external iliac artery	Red fox	2.06-3.64	2.95	0.355	12.03	4.475***
	Silver fox	1.40-3.66	2.67	0.411	15.39	
Diameter of aorta below the descent of external iliac arteries	Red fox	2.11 - 3.56	2.84	0.348	12.25	1.324
	Silver fox	1.68-3.82	2.76	0.386	13.98	
Diameter of left internal iliac artery	Red fox	1.17-2.35	1.75	0.238	13.60	2.318**
	Silver fox	0.82-2.21	1.65	0.288	17.45	
Diameter of right internal iliac artery	Red fox	1.14-2.52	1.83	0.271	14.84	4.471***
	Silver fox	0.78-2.17	1.61	0.318	19.75	
Diameter of median caudal artery	Red fox	1.03-2.02	1.44	0.225	15.62	0.171
	Silver fox	0.58-2.09	1.43	0.305	21.33	

Level of significance for: P 0.05 -(*) – significant; P 0.01 (**) – highly significant; P 0.001 (***) – very highly significant.

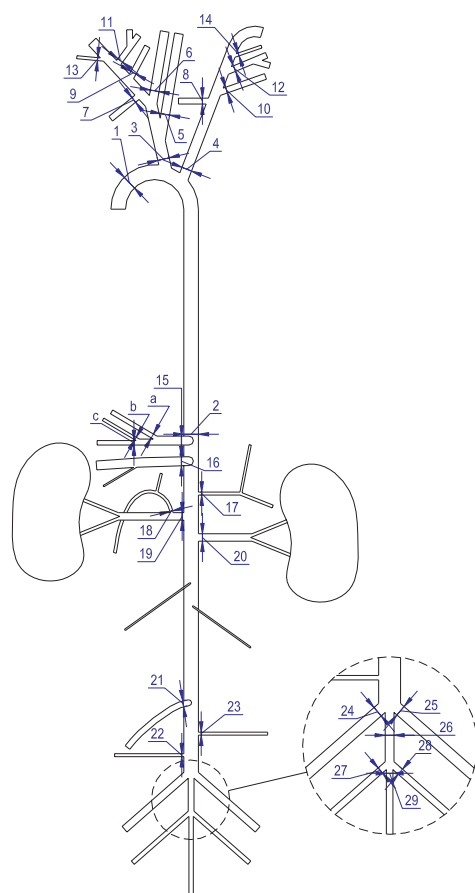


Fig. 1. Diagram showing places of measurements of diameters of aorta and its branches: 1 – aortic arch; 2 – abdominal aorta; 3 – brachiocephalic trunk; 4 – left subclavian artery; 5 – left common carotid artery; 6 – right common carotid artery; 7 – right internal thoracic artery; 8 – left internal thoracic artery; 9 – right vertebral artery; 10 – left vertebral artery; 11 – right costocervical trunk; 12 – left costocervical trunk; 13 – right superficial cervical artery; 14 – left superficial cervical artery; 15 – coeliac trunk; a – common hepatic artery; b – left gastric artery; c – splenic artery; 16 – cranial mesenteric artery; 17 – left phrenoabdominal artery; 18 – right phrenocaudal artery; 19 – right renal artery; 20 – left renal artery; 21 – caudal mesenteric artery; 22 – right deep circumflex iliac artery; 23 – left deep circumflex iliac artery; 24 – right external iliac artery; 25 – left external iliac artery; 26 – aorta below the descent of external iliac arteries; 27 – right internal iliac artery; 28 – left internal iliac artery; 29 – median caudal artery.

Breeding and breeding practices aimed at, among others, increasing the size of individuals.

Although the length in farm silver fox exceeded those in red fox, the biometric measurements of the aorta showed that the aorta in the wild fox is longer. The difference in the length was significant and accounted for 2.46%. The length of the thoracic aorta was similar; however the difference was greater and accounted for 6.52%.

Greater differences were noted in the diameters of the aortic arch and abdominal aorta between these measurements in red and silver fox. They were highly significant and accounted for 11.19%

of the diameter of the aortic arch and 14.82% of the diameter of abdominal aorta.

Significant differences in the diameters and lengths between the red and silver fox were found almost in all the arteries descending from the aortic arch. Especially high differences were recorded in the measurements of diameters of common carotid arteries. In red fox the diameters were about 20% greater, 21.54% for the right artery and 19.23% for the left artery.

The results of measurements of the diameters of arteries descending from the abdominal aorta were slightly different; the differences were significant, and even highly significant, with red fox being superior.

The results presented allowed the investigation of morphometric variation of aorta in two fox forms, in wild and farm fox. The present paper is, in a way, an answer to the question whether breeding may have affected the anatomy of the arterial pattern in fox.

Conclusions

1. Comparative studies showed differences in the aorta morphometric arrangement between wild fox (*Vulpes vulpes* L.) and farm silver fox (*Vulpes vulpes fulva* Desm.).

2. Metrical variation was seen in greater aorta length and greater diameters of the vessels in red fox, while silver fox showed a shortened thoracic aorta and increased diameters of abdominal aorta branches.

References

- BRUDNICKI W., JABŁOŃSKI R., SKOCZYLAŚ B. 1986. The cases of multiple renal arteries in racoon (*Nyctereutes procyonoides* Gray). *Zesz. Nauk. ATR Bydgoszcz* **140** (Zoot. 14): 25-28 (In Polish).
- JAROSZ S. 1993. *Fur Animal Growing*. PWN Warszawa-Kraków. (In Polish).
- KNASIECKA V. 1986a. Branches of the hepatic artery in silver fox. *Folia morfol. (Warszawa)* **45**: 96-101.
- KNASIECKA V. 1986 b. The division of celiac artery *Foxes (Vulpes vulpes* L. 1758). *Folia morfol. Warszawa XLV*, **1**: 49-52.
- KNASIECKA V. 1987. Arteries of the aortic arch in pastel fox *Vulpes vulpes fulva*. *Folia morphol. Warszawa* **46**: 39-44.
- PILARSKI W. 1978. *Vetanatimic Dictionary*. PWN, Warszawa. (In Polish).
- WILAND C. 1974. Factors inducing the mutability of arteries at the basis of encephalon in Mammals. *Prz. Zool. XVIII.3*: 400-416. (In Polish).
- WILAND C., KUBICA J., ZAWADZIŃSKA B. 1996. The multiple renal arteries in the silver fox (*Vulpes vulpes* L.). *Zesz. Nauk. ATR Bydgoszcz* Nr **204**(Zoot.28): 35-40. (In Polish).