Anatomical, Histological and Doppler Findings of the Utero-ovarian Flow Pattern in Non-Pregnant and Pregnant Adult Egyptian Domestic Cats (*Felis domestica*)

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Abstract

The present study was carried out on non-pregnant and pregnant sexually adult Egyptian domestic queens to investigate the morphology of ovaries, uterus and Doppler findings to their arterial blood flow. The experimental group composed of eighteen (n= 18) female cats (3–6 years old) and four tomcats used for the mating method (6–9 years old). Four animals from total number were used for dissection, histological preparation and latex injection. The ovary and uterus were supplied by the ovarian artery and uterine one, these arteries varied between pregnant and non-pregnant cats and Doppler concerns these findings. Doppler velocities increased to reach the highest value of mating day and then decreased in both the uterine artery and also a branch of the ovarian artery reached to the entire uterus, in addition to the flow rate and volume increased markedly on the mating day. Both Doppler velocities and Doppler indices are measured in pregnant cats till day 30 of pregnancy in normal pregnant cats (Day 0 = day of mating), as the two Doppler velocities increased linearly till reached a maximum value of day 30, while two Doppler indices decreased linearly from day 0 till day 30, in addition to blood flow rate and volume increased similar to blood velocities. In conclusion: complete examination with anatomical, histological and Doppler findings in utero-ovarian vascularization waveform is essential to differentiate between non-pregnant and pregnant adult domestic cats in order to facilitate early diagnosis of any abnormalities in the feline genital tract and to predict the vascularity status.

Keywords: Anatomy; Blood flow; Cat; Doppler; Histology; Uterus

Introduction

The domestic cat (*Felis catus*) is one of the most widespread and popular pets. It considers a good module for studying and research, as they have some physiological features common with a human than experimental rabbits or rodents, also used in behavioral and biomedical researches, especially in the neurological study (James, 1995). Doppler ultrasonographic technology is considered an important diagnostic tool for the assessment of veterinary medicine (Abdelnaby et al., 2016; and Abdelnaby et al., 2018). This method provides accurate information about the genital organ blood perfusion (Panarace et al.,2006 and 2008) as well as the direction of blood flow by color mode to differentiate between arterial and venous flow waveform velocities (Bollwein et al.,2004; Blanco et al.,2018). Doppler ultrasonography determines the variation in vascularity in relation to Doppler parameters (Szatmári et al., 2001). Therefore, our objectives were to enhance basic anatomical data and Doppler ultrasound technique on female cat's reproductive organs which considered as an instrumental method for aiding in clinical practice and diagnosis of uterine abnormalities as well as providing the veterinary surgeon with important records concerning the arterial organization in this species; and to determine Doppler parameters in the arteries of cyclic non-pregnant and pregnant domestic cats.

Material and Methods

1. Animals and housing

The study was performed in the small animal cattery, Department of Theriogenology, at Cairo University, Giza square.

2. Experimental animals

Sexually adult healthy cyclic Egyptian domestic queens (*Felis catus*) were used. The tentative group was comprised of eighteen (n= 18) female ranged from (3–6 years old, 4–6 kg) and (n=4) males used for the mating process (6–9 years old, 5–7 kg). All queens were kept in the cattery. Animals were nourished a commercial feed (dry type) with the presence of water ad libitum .

3. Detection of estrous phase and mating with tomcat:

All queens (n= 18) were evaluated and detected for symptoms of sexual activity twice times in each day. Once confirmed that the queen was in the estrus phase, she must get closer twice to tomcat individually in an outdoor place on 2nd, 3rd, 4th and 5th days and the last mating day may be the zero day until the first day of pregnancy (day 0-1) (Pereira et al., 2011).

4. Animals used for anatomical and histological studies:

Ovario-hysterectomy was done on one experimental cyclic non-pregnant animal. Euthanized to one non-pregnant cat has Multi-centric lymphoma that extends to inguinal lymph nodes and two pregnant cats, one suffers from a spinal fracture while the other suffered from severe pelvic fracture and placental separation. They were euthanized by the method of The Humane Society of the United States (2013). The incision was sutured surgically by several layers then finally the skin sutures were placed, after ten days the skin sutures were removed. Operation is performed by Preoperative analgesia: ketamine for painlessness (5–10 mg/kg by IM route), sedation by using Acepromazine (0.01–0.05 mg/kg IM injection), also induction by tiletamine intramuscularly (3–4 mg/kg) and then maintenance by propofol IV (1/3 or 1/2 of initial dose). Pre-Euthanasia Drug: I/M injection of PreMix (a combination of xylazine and ketamine), 0.5 milliliter for every 10 pounds then I/V injection of sodium pentobarbital into the femoral vein (1 ml/10 pounds).

4.1. Anatomical preparation:

Abdominal incision was applied for demonstration of ovaries and uterus, also the abdominal aorta was injected by colored latex neoprene for investigation of arterial blood supply. The obtained results were photographed using Nikon digital camera 10x zoom and 16 megapixels. The nomenclature used was in accordance to Nomina Anatomica Veterinaria (2017).

4.2. Histological Preparation :

The ovary and uterus of pregnant and non-pregnant cats were directly separated out and segmented into small pieces. Neutral buffer formalin 10% used for fixation of some samples and Bouin's fluid used for other fixation. The blocks were dehydrated using ethanol, cleared using xylene and then after embedded in paraplast. Serial sections were cut at a thickness of 5-6 µm using rotatory-microtome and stained with Hematoxylin and Eosin (H&E)

5. Ultrasonographic examination:

The cyclic non-pregnant queens were observed during one-two estrus without any mating, and then they were mated in the next upcoming estrus in order to become pregnant. The uteroovarian vascular perfusion of all queens was examined daily by throughout one estrous cycle. The assessment happened on the Proestrous (1-2 days), day of mating (accept a male for 24 hrs) and days after mating (1-2 days) during the progesterone-dominant phase in the luteal phase as confirmed by the luteal diameter which increased gradually with an increase of serum progesterone levels. The clear mating with the male was not permissible, then was permitted daily till following estrous was showed. During the course of pregnancy, routine ultrasound assessments were achieved every five days (0, 5, 10, 15, 20, 25, and 30) till validation of pregnancy ended on day 30 with the presence of embryos heartbeat by Doppler

5.1. Doppler scanner:

A Doppler ultrasound color and pulsed wave scanner prepared with 7.5 MHz frequency was used to determine changes the in female genital tract vascularization. Animals were examined without any sedation or analgesics agents. The device setting: maximum 25 cm/s velocity appeared on the screen with Doppler wall filter at 100 Hz and insonation known angle was 45 ± 5° (Silva et al., 2005)

5.2. Uteroovarian blood supply

Sections of the ovarian and uterine arteries were estimated. The spectral graph determined the mesometrial attachment blood supply as designated previously (Silva et al., 2005). The Doppler end points measures were resistance index (RI), pulsatility index (PI), peak systolic velocity (PSV), end-diastolic velocity (EDV) and rate of the blood flow (Ginther, 2007)

6. Statistical analysis

The outcomes were also evaluated using SPSS. The variables were two chief groups (normal cyclic non-pregnant cats and normal pregnant cats till day 30). The data were regarding the length of the estrous cycle; acceptance and refusal periods are expressed as the means ± SEM. The average value of the variables Doppler guides the two ovarian and uterine arteries; Doppler speeds, rate and volume of blood flow were estimated.

Results

1. Anatomical Finding:

1. Morphology

A- Ovary (Ovarium) (Fig 1), was oval in shape with flattened surfaces, smooth in appearance, situated ventral to the lumbar vertebrae between the third to fourth lumbar vertebra, in close contact to the kidney cranially. The ovary suspended in the dorsal abdominal cavity by mesovarium and attached caudally with the uterine horn by a proper ligament of the ovary (Fig 1A). There was a pouch known as ovarian bursa (Fig 1B) that partially covered the ovary, it was formed by Mesosalpinx and proper ovarian ligament. In the pregnant cat, the ovaries were smooth, large with rounded extremities. Its shape was observed in the first stage of pregnancy as the heart on playing cards.

B- Uterus (Uterus) (Fig 2A), was a Y-shape, with a long uterine horn about 3-4 cm in length and a short body, about 0.5-1 cm. It was suspended in the pelvic cavity by two ligaments, the broad ligament (Fig 1C) and the round ligament (Fig 1D). The uterine horn (Fig 2B), increased in length in the pregnant cat reached 5-6 cm. There were two dilatations (Fig 2B/1).in each horn with a constriction in between

(Fig 2B/2); each ampulla of that dilatation contained a fetus.

2. Histological Finding:

A- Ovary. The microscopic structure of the feline ovary consists of the lining epithelium then the germ cells under the surface and the stroma in the middle. In pregnant cat, there are atretic follicles under the surface surrounded by interstitial cells and the presence of corpus luteum. On the other hand, the ovary of the non-pregnant cat has a different stage of folliculogenesis (primordial, secondary, tertiary, Graafian follicles), corpus luteum from non-copulatory ovulation found in the stroma (Figs 3A and 3B).

B-Uterus. The microscopic structure of the feline uterus consists of lamina epithelialis of simple columnar type; lamina propria contains glandular tissue, lamina vasculosa and tunica muscularis of inner circular, oblique and outer longitudinal muscle fibers. In the non-pregnant cat, another epithelium is non-branched and non-secretory, the uterine glands are ill developed and the tunica vasculosa at its lowest development. While, in the pregnant cat, the lining epithelium is active, branched and secretory, the uterine glands are well developed; the tunica vasculosa is well developed also (Figs 3C and 3D).

3. Arterial Supply

The ovarian artery and the internal iliac artery of the abdominal aorta were the master branches carried the blood to the ovary and uterus.

A-In non-pregnant queen;

A.1- The ovarian artery (A. ovarica) (Fig 4A/1), was emerged from the ventral face of the abdominal aorta, passed in the broad ligament, after detaching the renal artery, it gave off a smaller branch supplied the surface of the ovary itself, the ovarian bursa and uterine horn.

A.2- The uterine artery (A. uterina) arose with the caudal vesical artery, from the cranial branch of the urogenital artery of the internal iliac artery (Fig 4B/11), and then the uterine artery (Fig 5/a) passed along the uterine horn in a cranial direction to supply it and anastomosed with the uterine branch of the ovarian artery on the wall of the uterine horn (Fig 5/a1).

B-In the pregnant queen;

B-1: The ovarian A., gave off the uterine branch of the ovarian artery (Ramus uterinus) (Fig 6/2), which was very large and more distinct as a separate branch, carrying blood to the cranial part of the horn and anastomosing with the uterine artery of the urogenital artery.

B.2: The uterine A., (Fig 6/a), showed no significant difference than the similar artery in the non-pregnant, except increasing the blood flow to the gravid horn for nourishing the feti. Also, the uterine artery was more tortuous than the same one in the non-pregnant cat.

2. Doppler findings:

All domestic cats are scanned by b. mode and Doppler ultrasound. The longitudinal axis of both ovaries (Figs 7a-7h) and uterus (Figs 8a-8h), are measured in both cyclic non-pregnant and pregnant queens. The number of the feti in each horn in the pregnant group is distributed along two uterine horns as depicted on (Table 1). Both Doppler velocities and Doppler indices are measured in pregnant cats during days (0,5,10,15,20,25, and 30) of pregnancy in normal pregnant cats (Day 0 = day of mating), as the two Doppler velocities increased linearly till reached a maximum value of day 30, while two Doppler indices decrease linearly from day 0 till day 30. In addition, blood flow rate and blood flow volume increased similar to blood velocities as shown in (Table 2). While, the same parameters measured in non-pregnant cyclic cats as depicted in (Table 3), as both Doppler velocities increased reaching the highest value of mating day and then decreased after mating in the uterine branch of the ovarian A. and in the uterine A. In addition, flow rate and volume showed a pattern of elevation on the day of mating while decrease before and after mating, On the contrary, both Doppler indices decreased reaching the lowest values on mating day as compared to the days before and after mating.

Discussion

1. Morphology

The ovary was oval in shape with flattened, smooth surfaces, situated in sublumbar region from 3rd to 4th lumber vertebra, and in close contact with the kidney cranially. That results are in a line with (AL-Delemi et al., 2010) in feral cat but in contrast with she-camel (Ali et al., 2007) where the ovary appeared, circular, with uneven surface containing many small follicles resembled a bunch of grapes. The study of Getty (1975) showed in mare a large bean shape ovary, situated from 4th to 5th lumber vertebra. A study (Miller, 1964) was observed small compact ovaries in the rabbit. In agreement with (AL-Delemi et al., 2010; Ali et al., 2007 and Getty, 1975) the ligaments of the ovary were mesovarian and proper ovarian ligament, attached it to the dorsal abdominal wall and uterine horn respectively. While two another studies (Getty, 1975 and Miller, 1964) showed a suspensory ligament attached to a diaphragm in a bitch that not present in our result. Our study recorded in a pregnant cat, the increase of ovarian size to appear as the heart on a playing card. Corresponding to (AL-Delemi et al.,2010; Getty,1975 and Miller,1964) in feral cat and dog, the uterus was Y- shape with long uterine horn and short uterine body, but both was longer in dog about 12-15 cm horn and 2-3 cm body (Ishaya et al., 2018), while our result was 3-4cm and 0.5-1cm respectively. The uterus of cows was cornuate in shape (Khaton et al., 2015) and resembled the letter T, with left horn longer than the right one (Srikandakumar et al., 2003) in camel. Our finding in pregnant queen showed that both uterine horns had two dilatations with constriction in between contained an embryo. However, another study (Brookshire et al., 2017) in a pregnant cat reported that only the right uterine horn had two spherical swellings contained a fetus (Srikandakumar et al., 2003 and McDonald ,1989) as in pregnant she-camel, cow and ewe that fetus presents only in the single uterine horn; while in while in a mare and primates it occurred in the uterine body (Hunter, 1982).

2. Histology

The ovary of a non-pregnant cat has a different stage of follicles (primordial, secondary, tertiary, Graafian follicles), that also recorded in short hair domestic cat (Ariel et al., 2016). While in rabbit (Ishaya et al., 2018) the cortex shows a primary follicle. As same as in (Brookshire et al., 2017) the ovary in pregnant cat showed multiple atretic follicles and corpus luteum. In accordance with (Brookshire et al.,2017) the endometrium epithelium of the pregnant uterus was branched and folded with well-developed uterine glands in lamina propria and tunica vasculosa

3. Arterial supply

In line with Miglino et al., (2001) in Portugalian cat and Demirkan et al., (2010) in chinchilla, the ovarian arteries were detached from the ventral face of the abdominal aorta and caudal to the renal artery where it gave off smaller branches to supply the ovaries and cranial part of the uterine horn. Our result added that the ovarian artery gave off the uterine branch which appeared very large and clear in the pregnant cat. The uterine artery arose from the cranial branch of the urogenital artery and passed cranially to supply the uterine horn where it anastomosed with the uterine branch detached from the main ovarian artery. That in parallel to (Getty, 1975 and Miller, 1964) in dog, But in Portugalian cat, it splits out from the vaginal artery (Miglino et al., 2001) and in contrast with chinchilla as it originated from the external iliac artery (Demirkan et al., 2010) and in pampas deer (Vazquez et al., 2018) reported that umbilical artery is the origin of the uterine artery. Our study reported that the uterine artery had been passed in a zigzag pattern in pregnant cat.

4. Doppler findings:

This study on domestic Egyptian queens is considered the first attempt that analyzes the ovarian and uterine hemodynamics changes. Also recorded, at hand was no clear dissimilarity in blood course among the two ovarian arteries and uterine arteries. Doppler indices showed an obvious decrease during the primary month of pregnancy when compared to the first day of mating and non-pregnant state, in both uterine branches of ovarian arteries and uterine arteries. This marked decrease expressed by the increase of both Doppler velocities as peak systolic and end-diastolic in addition to a marked significant increase in BF rate and BF volume throughout the first month of gestation, when compared to cyclic non-pregnant condition. Similar to our investigation, (Pereira et al., 2011) reported that both Doppler indices decreased. A known vessel characterized by low vascular resistance which was expressed by low RI and PI values , that decrease in resistance of vascularization has also been pronounced in cows, in which there was a marked decline in RI values till pregnancy end. Bollwein et al (2002) stated that, the uterine vascularization elevation can be recognized by increasing the diameter of the specifically known artery. According to Bollwein et al (2004), several changes were occurred throughout the placentation development in mares could lead to marked variations in the uterine blood stream, adding differences in the uterine supply, which are vital during embryonic and fetal development. Through gestation in cows, effectual structural and mechanical dissimilarities occurred in the uteroplacental circulation as an outcome of elevating the requirements of fetus (Ferrel, 1991). But, more studies are desired to enhance knowing as well as understanding the actions that occur in the uterine blood supply and vascular perfusion and to create the likely bond between uterine velocities arterial flow pattern and embryo embedding and placentation in cats. In bitches, both Doppler indices standards of the uterine artery decrease with the stage of gestation, which reveals the clear linear elevation in the vascular perfusion to the uterus (Miranda et al., 2010). However, in cats, their values decrease, especially in the widely major uterine horn, are not as well enclosed as in bitches. The evaluation of normal blood flow during normal cyclic and pregnant queens could be helpful in the detection of abnormities present in the vascularity pattern .This results in parallel to those stated in learning the uterine arteries velocities waveform in bovines (Bollwein et al., 2000), equines (Bollwein et al., 2004), and cats (Brito et al., 2010). But there is very little information available on ovarian arteries velocities waveform pattern with its branches hemodynamics changes in feline species.

Conclusion

According to the current investigation, the ovaries, uterine horns, and uterine body are accessible easily by ultrasound, with the aid of high frequency rectal or linear transducer at any stage of the cycle as well as in the pregnant condition. In addition total examination with anatomical, histological and Doppler findings are essential to differentiate between non-pregnant and pregnant adult Egyptian domestic cats. The correlation between the b-mode, color and spectral Doppler images and the anatomical with histological findings, is important to facilitate early diagnosis of any abnormalities in the feline genital tract and to predict the vascularity status for future breeding.

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Declaration of Interest

The authors declare that they have non-financial or personal relationship with other people or organizations that could in-appropriately influence or bias this article.

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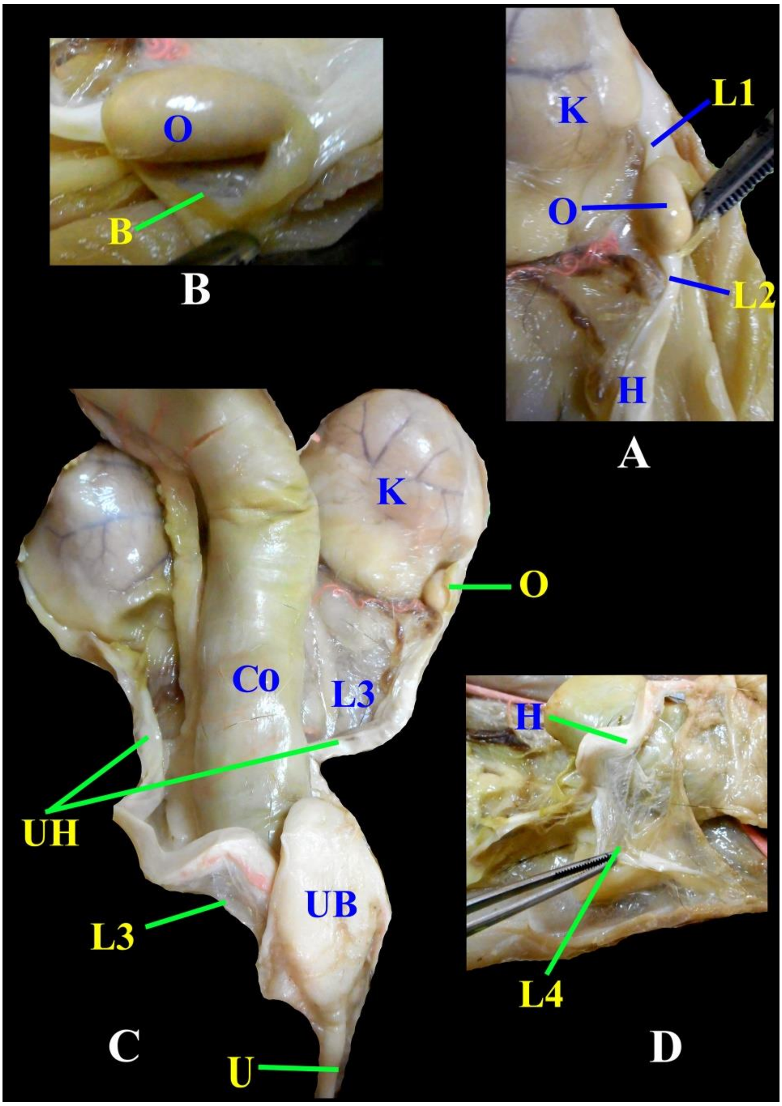


Fig (1): Photograph showing the morphology of the ovary in the cat

K- Kidney, CO- Colon, O- Ovary, UB- Urinary Bladder, B- Ovarian Bursa, UH -Horn of uterus, U- Urethra, L1- Mesovarium, L2- Proper ovarian ligament, L3-Broad ligament, L4- Round Ligament.

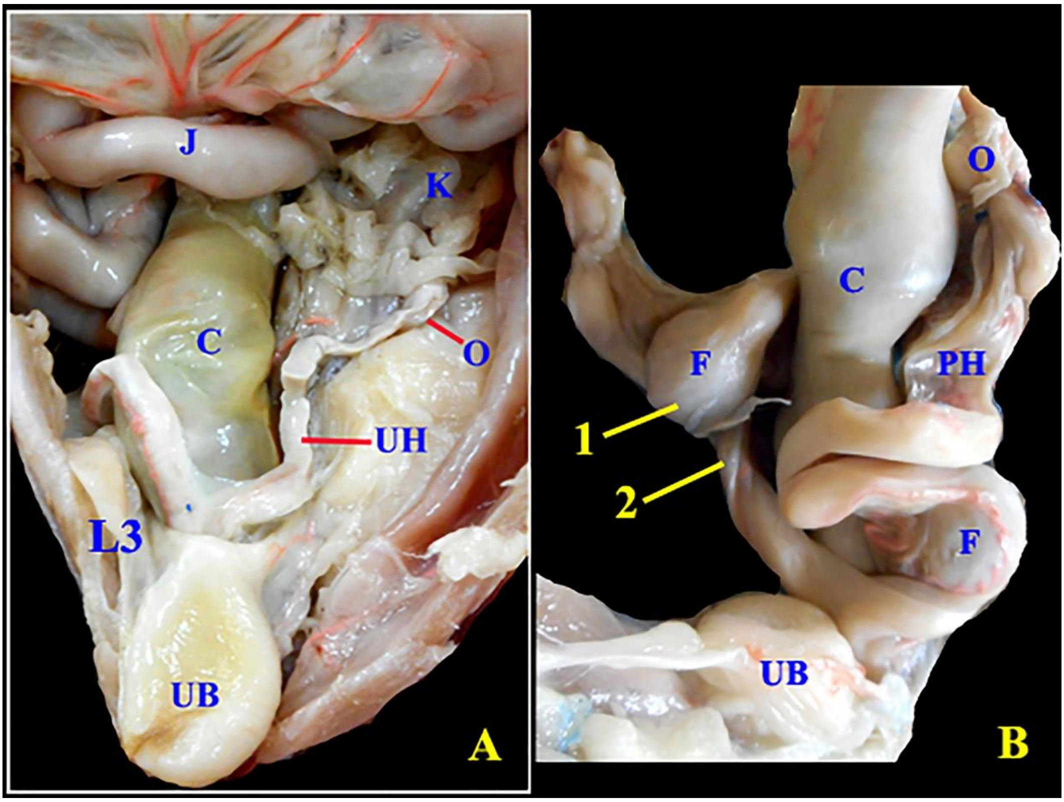


Fig (2): Photograph showing the morphology of the ovary and uterus in A- Non-Pregnant cat, B- Pregnant cat.

C- Colon, O- Ovary, UB- Urinary Bladder, UH- Uterine Horn, PH- Pregnant Horn, F- Fetus, L3- Broad Ligament, 1- Ampulla (Dilatation), 2- Constriction.

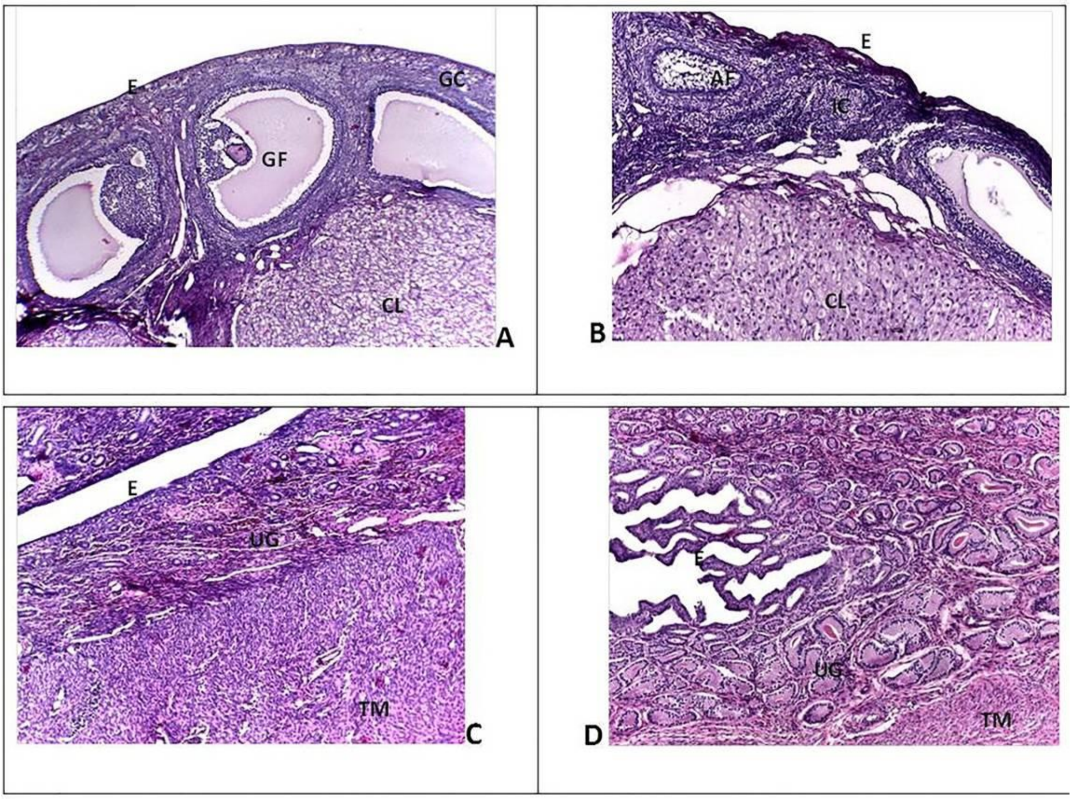


Fig (3): A & B Histological transverse section of the feline ovary and C & D Transverse section of the feline uterus.

A. non-pregnant, B. pregnant: CL, corpus luteum; AF, atretic follicle; IC, interstitial cells; E, epithelium, GC, germ cells; GF, Graafian follicle. H&E 100 X.
C. non-pregnant, D. pregnant: UG, uterine glands; TM, tunica musculosa; E, epithelium. H&E 100 X.

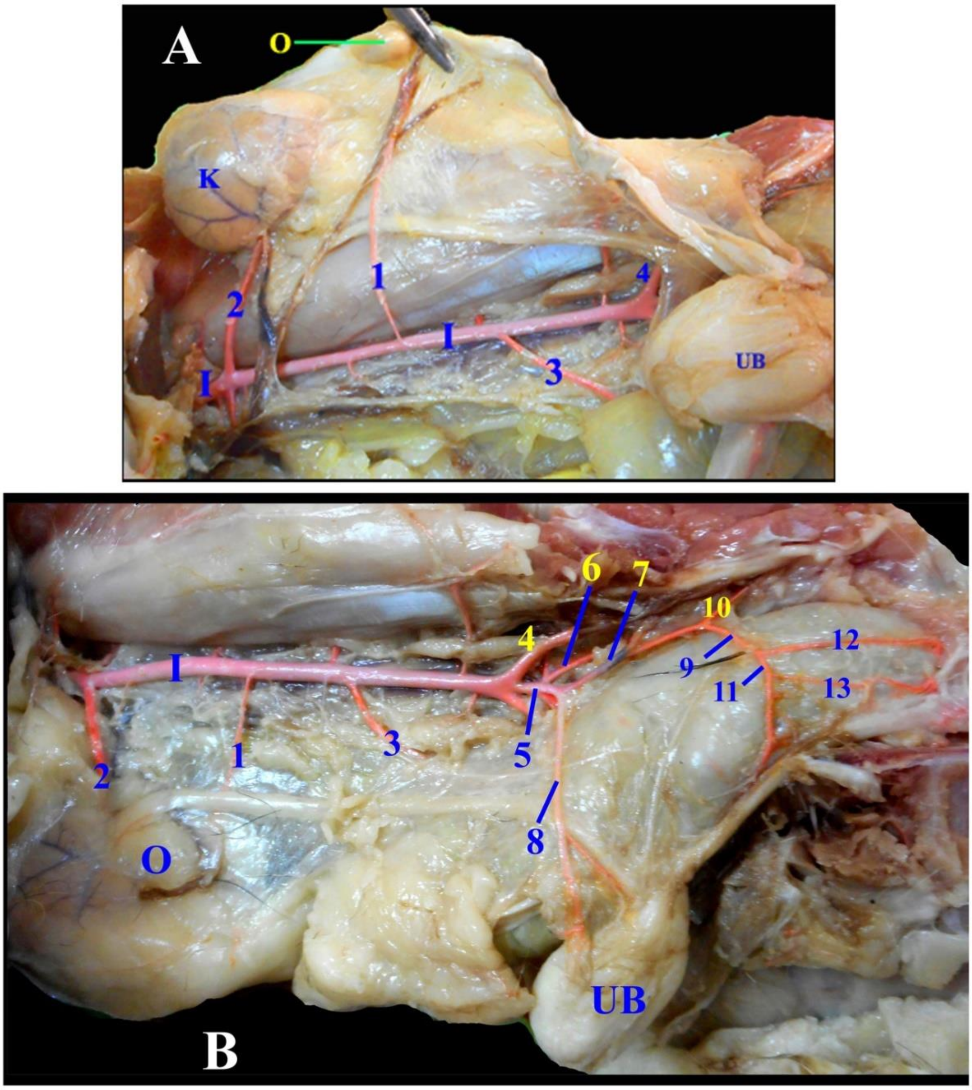


Fig (4): Photograph showing the origin of the ovarian and the internal iliac artery in the cat.

O- Ovary, K- Kidney, C- Colon, UB- Urinary Bladder, I- Abdominal aorta, 1- Ovarian A., 2- Renal A., 3- Caudal Mesenteric A., 4- External iliac A, 5- Internal Iliac A., 6- Partial branch of 5., 7- Visceral branch of 5., 8- Cranial Vesical A., 9- Urogenital A., 10- Internal pudendal A., 11- Cranial branch of urogenital, 12- Caudal branch of urogenital, 13- Vaginal A,. a- Uterine A.

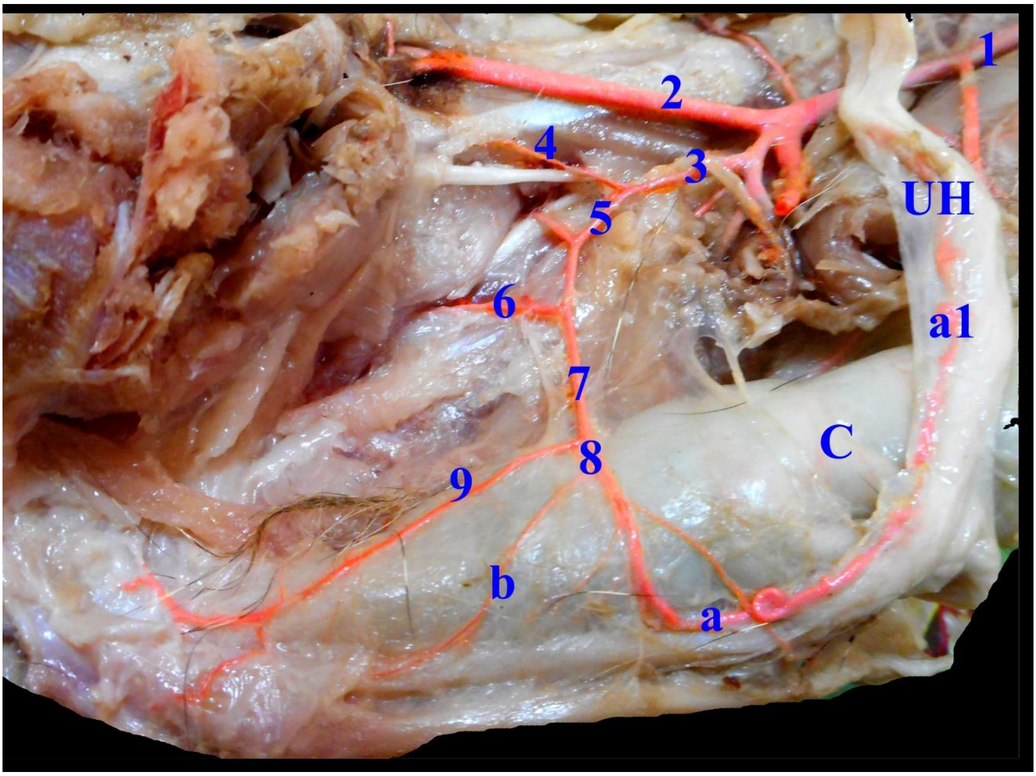


Fig (5): Photograph showing the origin of uterine artery in non-pregnant cat.

C- Colon, UH- Uterine horn.,1- Abdominal aorta, 2- External iliac A, 3- Internal Iliac A., 4- Partial branch of 3., 5- Visceral branch of 3., 6- Internal pudendal A., 7- Uro-genital A., 8- Cranial branch of urogenital, 9- Caudal branch of urogenital a- Uterine A., a1- Anastomosis between uterine A and ovarian A., b- Vaginal A.

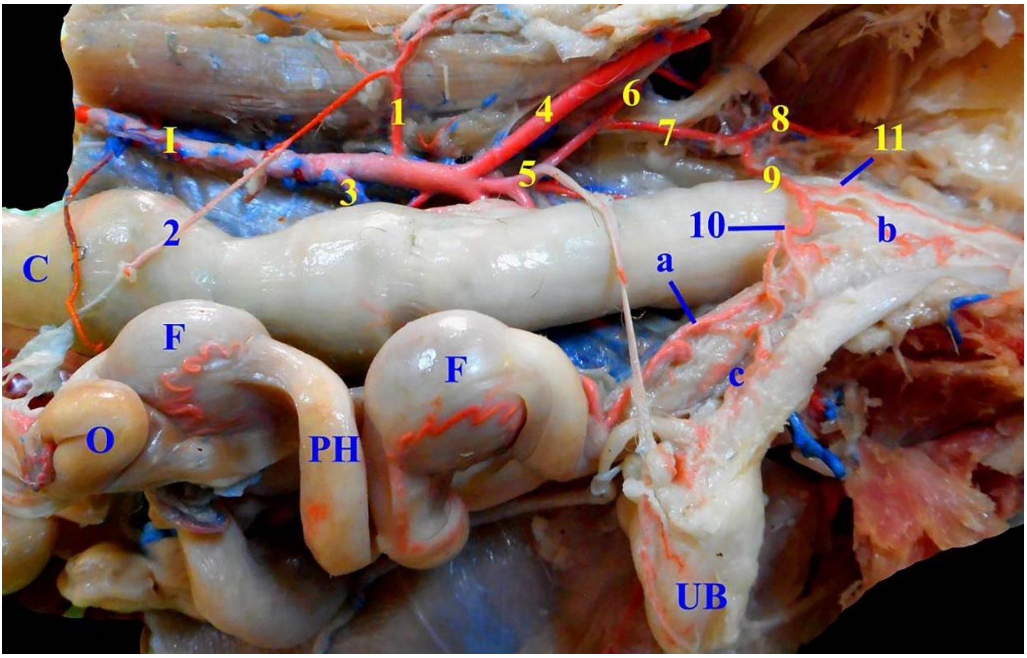


Fig (6): Photograph showing the origin of uterine artery in the pregnant cat.

C- Colon, PH- Pregnant horn., f- Fetus., UB- Urinary Bladder, I- Abdominal aorta, 1- Ovarian A., 2- Uterine branch of ovarian A., 3- Caudal Mesenteric A., 4- External iliac A, 5- - Internal Iliac A., 6- Partial branch of 5., 7- Visceral branch of 5., 8- Internal pudendal A., 9- Urogenital A.., 10- Cranial branch of 9., 11- Caudal branch of 9., a- Uterine A., b- Vaginal A., c- Caudal vesical A..

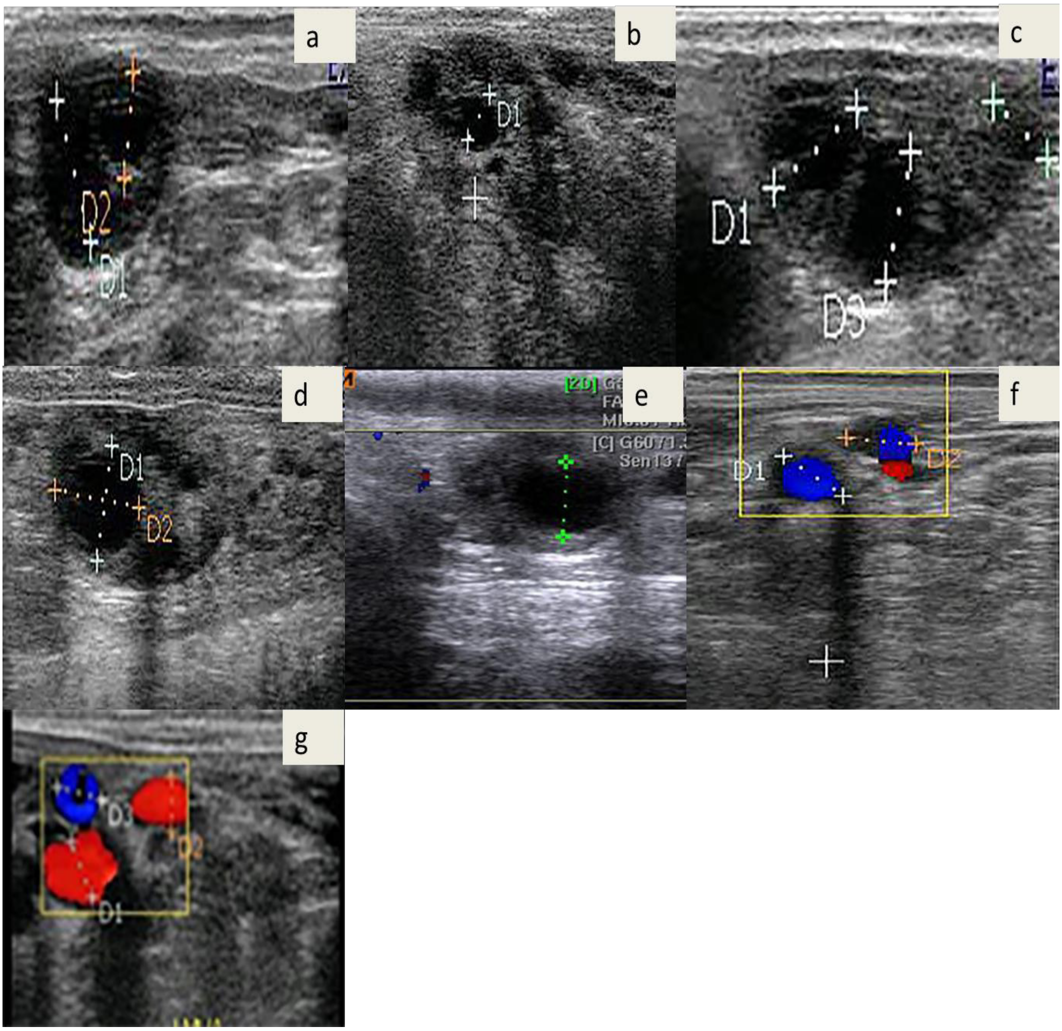


Fig (7): B mode and Doppler ultrasonogram long-axis scanning of the feline ovaries .The ovary measures 9.7mm with minor and major follicles are visualized during the proestrous (a and b) and the ovarian parenchyma appeared homogenous , The ovary measures 11.3 mm with large follicles can also be scanned at the day of accept male and the day of actual mating(c), the ovary increased in diameter and appeared with a hyper echoic medulla compared to ovarian cortex as shown in (d,e,f) in the pregnant cats at day 10,15,20 after mating , the uterine branch of cross-sectional ovarian artery in cyclic cats marked with blue color(g) and the coloration of the same branch in pregnant queens (h) by color and spectral Doppler.

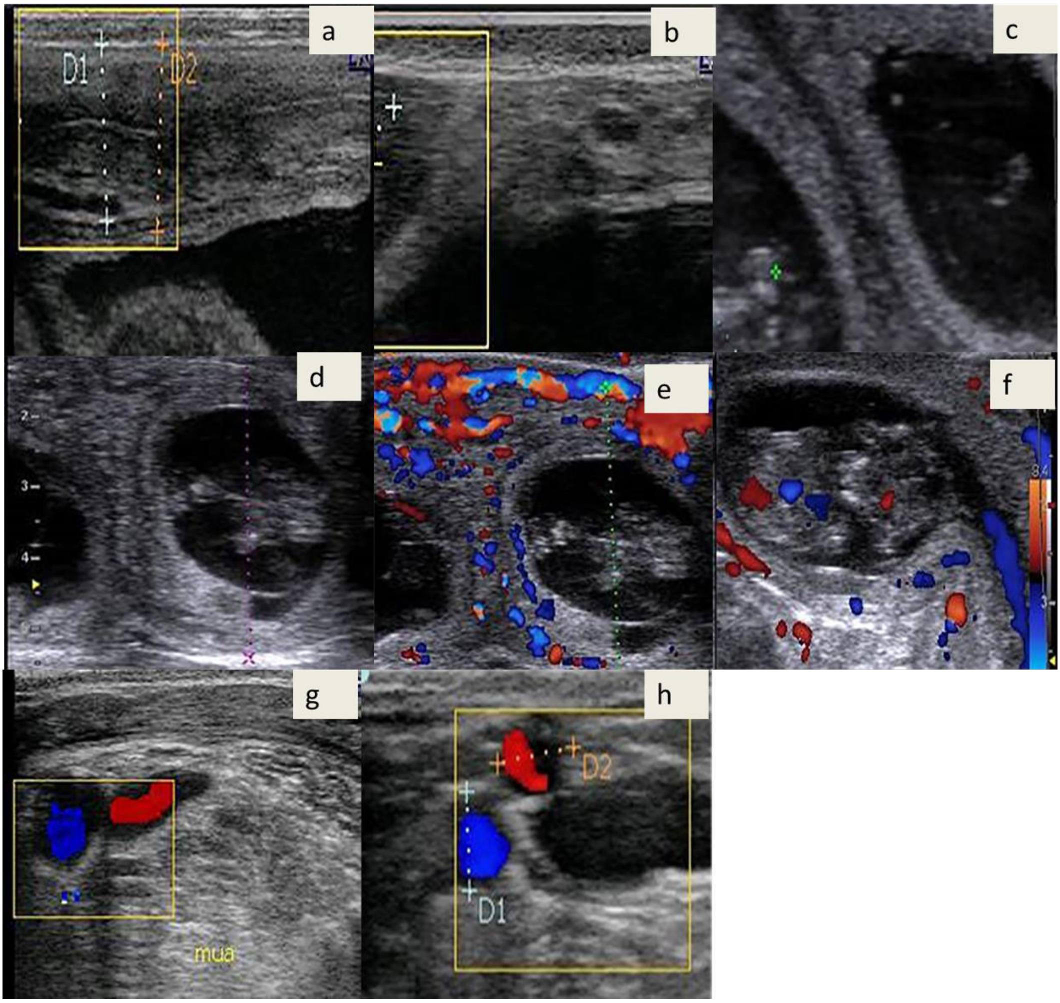


Fig (8): B mode and Doppler ultrasonogram long-axis scanning of the feline uterine body diameter (1.8 mm) with endometrium appeared as thin hyper-echoic line in the middle (a), and uterine horn in proestrous phase(b),in pregnant cats intrauterine fluids appeared inside the lumen of feline uterus (c),as pregnancy progresses ,the gestational sacs start to develop and easily scanned (d, at day 15),at day 20 embryos are scanned inside the gestational sacs (e) by color Doppler to make visualization of the embryo heartbeat, at day 30 (f) the embryos increased in size and evaluated by pules Doppler ,the uterine arteries also differ from non-pregnant cyclic queens(g) to pregnant ones(h) marked with blue color.

Table (1): Distribution of fetus no per horn in 16 pregnant queens scanned by ultrasonography.

R.U.H=right uterine horn
L.U.H= left uterine horn

Queen number	R.U.H	L.U.H
1	2	2
2	3	3
3	2	5
4	2	2
5	3	3
6	2	2
7	3	3
8	3	3
9	2	2
10	2	3
11	2	2
12	2	2
13	2	1
14	1	2
15	3	3

Table (2): Mean± SEM peak systolic velocity(PSV, cm/sec),end diastolic velocity(EDV, cm/sec), pulsatility index(PI) ,resistance index(RI) ,blood flow rate(BFR, bpm) and blood flow volume**(BFV, ml/m)** of both uterine branch of ovarian arteries(UBOA) and uterine arteries (UA) in 14 pregnant queens assessed every 5 days during normal pregnancy (Day 0 = day of mating)
Means with different superscript within rows are significant (p≤ 0.05) between days of pregnancy

Artery	Days of pregnancy						
	0	5	10	15	20	25	30
UBOA							
PSV	15.35 ± 0.02^{a}	17.01 ± $1.01a^{b}$	17.33 ± 0.33^{ab}	17.95 ± 0.25^{ab}	18.02 ± 0.15^{ab}	18.41 ± 1.54^{b}	18.63 ± 2.01^{b}
EDV	3.01 ± 0.01^{a}	3.21 ± 0.22^{a}	3.58 ± 0.01^{ab}	3.81 ± 0.21^{ab}	4.01 ± 0.01^{ab}	4.05 ± 1.01^{b}	4.11 ± 0.01^{b}
PI	1.25 ± 0.01^{b}	1.22 ± 0.02^{b}	1.19 ± 0.02^{ab}	1.15 ± 0.03^{ab}	1.09 ± 0.05^{ab}	1.05 ± 0.01^{a}	1.03 ± 0.01^{a}
RI	0.73 ± 0.01^{b}	0.66 ± 0.02^{b}	0.63 ± 0.01^{ab}	0.61 ± 0.02^{ab}	0.59 ± 0.01^{ab}	0.57 ± 0.02^{a}	0.53 ± 0.01^{a}
BFR	47.45 ± 2.01^{a}	49.67 ± 3.66^{a}	51.78 ± 5.64^{ab}	54.87 ± 3.69^{ab}	57.98 ± 7.36^{ab}	60.12 ± 5.98^{b}	60.21 ± 9.65^{b}
BFV	8.03 ± 1.20^{a}	8.12 ± 1.32^{ab}	8.32 ± 0.65^{ab}	8.45 ± 0.47^{ab}	8.67 ± 0.35^{ab}	8.98 ± 1.02^{b}	9.08 ± 1.21^{b}
UA							
PSV	16.05 ± 1.02^{a}	17.43 ± 1.32^{ab}	17.66 ± 1.05^{ab}	18.01 ± 0.85^{b}	18.38 ± 0.65^{b}	18.55 ± 0.47^{bc}	18.96 ± 1.08^{c}
EDV	4.11 ± 0.01^{a}	4.25 ± 0.01^{a}	4.39 ± 0.52^{a}	4.66 ± 0.32^{ab}	55.02 ± 0.62^{ab}	5.11 ± 0.32^{b}	5.13 ± 0.41^{b}
PI	1.21 ± 0.01	1.19 ± 0.01	1.18 ± 0.01	0.99 ± 0.01	0.98 ± 0.02	0.95 ± 0.02	0.85 ± 0.01
RI	0.69 ± 0.01	0.65 ± 0.02	0.61 ± 0.02	0.58 ± 0.02	0.54 ± 0.01	0.53 ± 0.01	0.51 ± 0.01
BFR	51.33 ± 2.01^{a}	55.36 ± 1.32^{ab}	58.32 ± 2.66^{ab}	59.33 ± 3.21^{ab}	60.38 ± 1.58^{ab}	62.82 ± 3.36^{b}	63.81 ± 4.25^{b}
BFV	8.32 ± 0.85^{a}	8.54 ± 0.47^{ab}	8.78 ± 0.65^{ab}	9.12 ± 0.08^{ab}	9.27 ± 1.44^{ab}	9.56 ± 1.02^{b}	9.90 ± 1.32^{b}

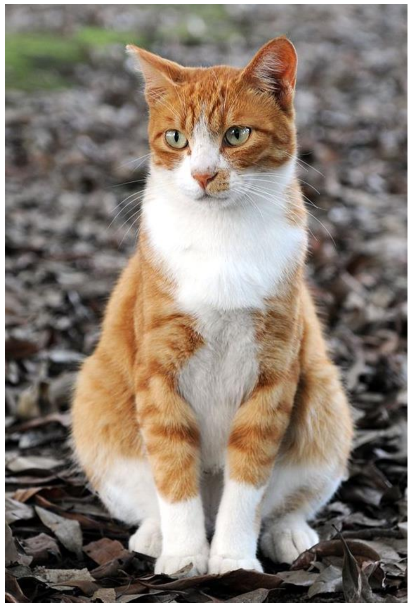
Table (3): Mean± SEM peak systolic velocity (PSV, cm/sec),end diastolic velocity(EDV, cm/sec), pulsatility index(PI) ,resistance index(RI) ,blood flow rate(BFR, bpm) and blood flow volume **(BFV, ml/m)** of both uterine branch of ovarian arteries(UBOA) and uterine arteries (UA)in cyclic non pregnant queens (n= 14)

Means with different superscripts within columns are significant ($p \le 0.05$) between days before and after mating PRO=P roestrous (1-2 day), M= day of mating (accept male for 24 hr), AM = after mating (1-2 day)

Cycle	UBOA						UA					
	PSV	EDV	PI	RI	BFR	BFV	PSV	EDV	PI	RI	BFR	BFV
PRO	13.55 ± 0.31^{a}	3.62 ± 0.02^{a}	1.12 ± 0.01^{b}	0.63 ± 0.01^{b}	46.32 ± 1.01^{a}	8.65 ± 0.12^{a}	15.96 ± 0.02^{a}	4.02 ± 0.11^{a}	1.32 ± 0.11^{b}	0.79 ± 0.01^{b}	51.27 ± 3.52^{a}	9.22 ± 0.01^{a}
M	16.35 ± 0.52^{b}	3.97 ± 0.01^{b}	1.02 ± 0.01^{a}	0.55 ± 0.02^{a}	51.68 ± 1.02^{b}	8.95 ± 0.22^{b}	18.63 ± 1.02^{b}	4.58 ± 0.22^{b}	1.11 ± 0.12^{a}	0.63 ± 0.01^{a}	55.47 ± 5.24^{b}	9.98 ± 0.01^{b}
AM	14.85 ± 0.31^{ab}	3.85 ± 0.01^{ab}	1.06 ± 0.02^{ab}	0.59 ± 0.02^{ab}	48.32 ± 1.25^{ab}	8.76 ± 0.01^{ab}	17.36 ± 1.55^{ab}	4.32 ± 0.02^{ab}	1.13 ± 0.32^{ab}	0.71 ± 0.01^{ab}	53.62 ± 2.31^{ab}	9.65 ± 0.02^{ab}

Animal species in this Issue

Domestic cat (*Felis catus* or *Felis silvestris catus*)



Kingdom: Animalia & Phylum: Chordata & Class: Mammalia & Order: Carnivora & Family: Felidae & Genus: *Felis* & Species: *F. catus*

The domestic cat is a small, usually furry, domesticated, and carnivorous mammal. It is often called a **housecat** when kept as an indoor pet. Cats are similar in anatomy to the other felids, with strong, flexible bodies, quick reflexes, sharp retractable claws, and teeth adapted to killing small prey. Cat senses fit a crepuscular and predatory ecological niche. Cats can hear sounds too faint or too high in frequency for human ears, such as those made by mice and other small animals. They can see in near darkness. Like most other mammals, cats have poorer color vision and a better sense of smell than humans.

The cat skull is unusual among mammals in having very large eye sockets and a powerful and specialized jaw. Within the jaw, cats have teeth adapted for killing prey and tearing meat. When it overpowers its prey, a cat delivers a lethal neck bite with its two long canine teeth, inserting them between two of the prey's vertebrae and severing its spinal cord, causing irreversible paralysis and death

Source: Wikipedia, the free encyclopaedia