

RESULTS OF THE STUDY OF SOME BIOCHEMICAL VALUES IN DOG AFTER SPAYING

E.Enkhbayar^{1*} and G.Gereltsetseg²

1-Veterinarian of “Enerekh” veterinary clinic, Mongolia

2-The school of Veterinary medicine, MULS, Mongolia

*-Corresponding author, e-mail: enkhbayar_007@yahoo.com

ABSTRACT

It is sometimes necessary to remove gonad of a dog during various age. In order to define the optimal age for spaying (ovariohysterectomy) female dogs, our study objectives were to investigate changes of hormonal and biochemical values in both immature and mature female dogs after spaying. Results of the study on sex hormone levels at different stages of female dog estrous cycle and biochemical values of only mature dogs were presented in this article. Highest progesterone concentration in female puppy occurs during diestrus (20-35 ng/ml), and estradiol level peaked (25-35 pg/ml) during proestrus. In mature dogs for one year after ovariohysterectomy, total proteins in plasma increased by 13.3%, albumin elevated by 31.1%, total lipids by 2.3 times, cholesterol by 3 times and plasma glucose by 2.3 times. Results of the study revealed removal of gonads or ovaries in female dogs leads to greater changes of metabolism, especially lipid or cholesterol metabolism disturbs at highest levels.

KEYWORDS: female dog, progesterone, estradiol, ovariohysterectomy, total protein, lipid, cholesterol, glucose

INTRODUCTION

The older the nulliparous bitch or queen (female cat) the higher the risks of suffering from inflammations or any other disorders of genital organs. With the purpose of preventing these disorders, majority of dog owners tend to allow their own female dogs or cats are subject to ovariohysterectomy. Ovariohysterectomy is made during various ages of the animal and then various changes such as body weight gain or behavioral disturbance.

In last years, the number of dog fanciers and breeders under domestic conditions is drastically increasing in our country and dogs of various breeds

are imported and bred. At present, in our country, especially in urban areas, Tibetan mastiff, Central Asian shepherd, German shepherd, Caucasian mountain shepherd, Siberian husky, Alaskan malamute and many other purebred dogs are being bred. In Ulaanbaatar, there are several dog breeders so-called “Has Banhar”, “Huder” and “Hotoch”, dog lovers clubs “Honch haltar”, “Mimi” and “Alma”, and “Unench naiz” LLC, which perform activities to breed or train various breed dogs.

In this conjunction, it has been essential to learn a number of issues including care, nutrition, health,

breeding and selection of dogs. Estrus of female dogs and cats arrives 2 or 3 times a year. A part of dog lovers tend to limit dog reproductive function, while others wish to multiply them and gain profits via purchase of the offspring of dogs. There are increasing number of issues such as learning reproduction physiology of dog and both positive

and adverse consequences due to reproductive function limits and prevention of disorders associated with aging of nulliparous bitch.

Therefore, the present study aimed to investigate normal sexual cycle of dogs and perform comparative study of changes occurred after spaying during both immature and mature ages of dogs.

MATERIALS AND METHODS

The study was undertaken in department of fundamental veterinary sciences, SVM, MULS, and “Enerekh” veterinary training center at Mongol VETNET NGO and Central medical laboratory of “Gyals”.

In this study, all animals were divided into two experimental groups; the first group has 5 or 6 months old or immature 4 puppies including only puppy in a control group (because a female puppy escaped during the mid of experiment, two puppies were used). During the 1st stage of this study, sex hormone levels at different stages of bitch estrous

cycle were estimated. Hormone concentrations were determined at laboratories of Grand Med hospital. Second group had 3 to 5 year old 4 mature dogs (all mated), including 2 were as control group. Dogs used in the study were mostly non-descript or crossbreds and 3 were spaniel and dwarf breed dogs. Ovaries and uterus of experimental dogs were removed by using conventional methods. Blood samples were taken at months 6 and 12 before and after ovariohysterectomy and used for measurement of some biochemical values. Analyses were performed in “Gyals” medical center laboratory.

RESULTS OF THE STUDY

Most researchers divide canine estrous cycle into 4 stages according to Hipp’s classification system. There are proestrus (pre-mucosal discharge), estrus (mucosal discharge), diestrus (post-mucosal discharge) and anestrus (stabilization) stages in

estrous cycle. We also used this classification in our study.

Changes of canine sex hormone, progesterone and estradiol concentrations during these stages were shown in the diagram 1.



Picture 1. Diagram of canine sex hormone changes

As shown in picture 1, progesterone level was stable as 1.0 ng/ml in female puppy at anestrus stage. During proestrus, progesterone concentration

increased gradually to 2.0-2.5 ng/ml. At estrus stage, it became 4.5-7.0 ng/ml which indicates formation of corpus luteum started. During diestrus stage,

progesterone level distinctly increased which reached 20-35ng/ml due to corpus luteum formation. It shows the progesterone level is higher by 20% than anestrus stage. If bitch didn't conceive, corpus luteum can be regressed, as well as progesterone concentration decreased to 2.0-1.0 ng/ml (anestrus stage level). At anestrus stage, progesterone level was stabilized below 1 ng/ml. Estradiol is the most active member of estrogenic hormones secreted from ovarian follicles of the ovaries. For this reason, estradiol reached its highest level as 25-35 pg/ml in proestrus stage, and then gradually decreased during estrus and diestrus, reached at the lowest level as 2-5 pg/ml and re-

stabilized at anestrus stage. Both of estradiol and progesterone hormones were at their lowest level and stabilized during anestrus.

This article deals with the results of study on biochemical parameters of only mature dogs after one year of spaying.

Changes of body weight for one year after removal of ovaries and uterus bitch were shown on table 1. This shows ovariectomy of mated dog resulted in the significant increase of body weight. Body weight of dogs with normal reproductive functions increased at relatively lower rate (3.5%), while body weight of experimental group dogs increased by 25.5%.

Table 1

Changes of body weight of dogs after spaying				
Body weight (kg)	Before spaying	After spaying		
		After 3 months	After 6 months	After 12 months
Experimental dogs	18.3±1.3	19.0 ±2.5	20±2.0	24.5±1.0
Control dogs	19.5 ±1	19.3±1,7	19.8±2	20.2±1,5

Dynamics of changing biochemical values in ovariectomized dogs were summarized in table 2.

Table 2 demonstrated that total proteins of blood plasma of experimental dogs before the experiment was 63.3 g/L. For 1 year after the operation for removal of gonads or ovaries and uterus of these

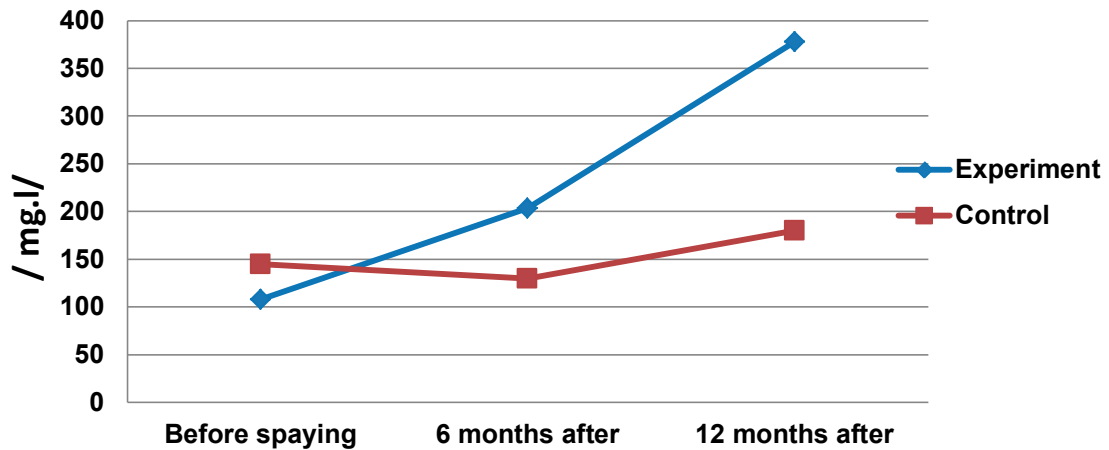
dogs, the parameter was increasing and reached 73.0 g/dl (14%). With concentrations of albumin, it was 3.1 g/L, then was increasing to 4.5 g/dl or as compared to a period before ovariectomy it increased by 31.1%. Control dog blood plasma total proteins increased by 6.5% for this period, while albumin fractionation decreased slightly.

Table 2

Changes of biochemical values before and after ovariectomy of dogs					
№	Parameters	Groups	Before	After	
				6 months	12 months
1.	Total proteins (g/L)	Experiment	63.3 ± 2.73	65.0 ± 2.5	73.0 ± 1.87
		Control	58 ± 1.8	59 ± 2.0	62 ± 1,9
2.	Albumin (g/dl)	Experiment	3.1 ± 0.05	4.1 ± 0.16	4.5 ± 0.08
		Control	3.8 ± 0.15	3.6 ± 0.21	3.0 ± 0.1
3	Lipids(mg/dl)	Experiment	601 ± 23,4	896 ± 23.5	1389 ± 42.7
		Control	580 ± 22.5	630 ± 19.5	650 ± 20
4	Cholesterol (mg/dl)	Experiment	107.9 ± 5.75	203.4 ± 9.6	318.0 ± 10.2
		Control	145 ± 3.75	130 ± 4.13	180 ± 5.3
5	Glucose (mmol/l)	Experiment	3.75 ± 0.08	7.8 ± 0.26	8.5 ± 0.27
		Control	2.9 ± 0.07	3.1 ± 0.31	3.2 ± 0.14

As a lipid metabolism indicator, blood plasma total lipid and cholesterol concentrations were measured. Blood plasma total lipid concentration before the operation was 601 mg/dl, whereas it increased to 1389 mg/dl or by 2.3 times for 1 year after spaying. But blood plasma total lipid concentration of dogs with normal reproductive functions increased by approximately 10 percent for this period. But blood

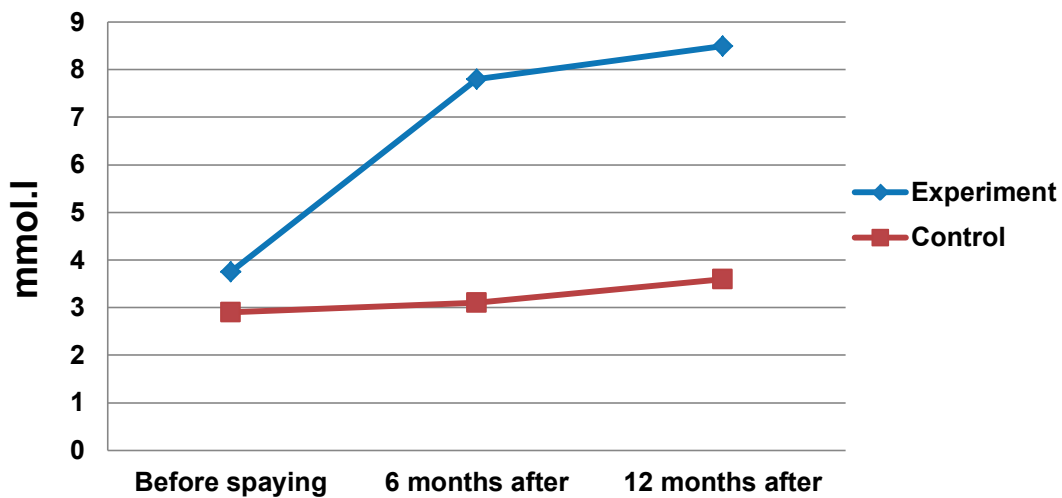
plasma cholesterol concentration was 107.9 mg/dl during normal period, and at month 6 after ovariectomy it also increased to 203.4 mg/dl or almost by 2 times, and after 1 year it reached 318 mg/dl or increased by 3 times. This parameter in control dogs was relatively lower or increased by 20% for this period.



Picture 2. Cholesterol concentrations

Blood plasma glucose as a major indicator of carbohydrate metabolism was 3.75 mmol/L before the spaying, while it increased by two times at 6 month after spaying and reached 8.5 mmol/L after

one year or it means the value increased by 2.3 times as compared to earlier period. However, a tendency of slight increase of blood glucose in control group was observed.



Picture 3. Glucose concentration

DISCUSSION

Concentration changes of sex hormones such as progesterone and estrogen in peripheral blood during the estrous cycle of bitch was studied by Blendinger et al. (2001) and Kustritz et al. (2000). The study showed progesterone concentration ranged below 1 ng/ml during anestrus, then gradually increased to 2-10 ng/ml in proestrus and estrus, and then reached the highest level or 15-80 ng/ml in diestrus stage. Christensen (2002) reported that estrogen concentration in canine blood was 25-50 pg/ml at the beginning of proestrus and then it increased to 120 pg/ml at the end. At hours 24 to 48 before the

estrus, concentration of luteinizing hormone increased immediately while concentration of estrogen decreased at the same period. On the contrary, progesterone concentration increased. Estrogen concentration in peripheral blood decreased until the end of estrus but progesterone concentration increased. Results of our study on progesterone and estrogen concentration differences during puppy’s reproductive states were consistent to the results of above mentioned studies.

Our study on dog blood plasma proteins demonstrated that total proteins of blood plasma in mature dogs with normal reproductive function after 1 year of spaying increased by 13.3% and albumin increased by 31.1%. According to study by Valiullina (2010), measurement of blood plasma protein concentrations of ovariohysterectomized dogs after 6 months revealed both albumin and gamma globulin fractionations increased by 22.4% and 3.3-23.7% respectively. Therefore, results of our study are principally in agreement with those demonstrated by above author.

As a result of our study, the blood plasma concentration of total lipid as the main lipid metabolic indicator in experimental dogs increased significantly by 2.3 times and cholesterol by 3 times. In the present study, we measured plasma glucose as the main indicator of carbohydrate metabolism and this indicator was 3.75 mmol/L, when mature dogs were in normal reproductive functions, whereas it was 7.8 mmol/L or increased by twice at month 6 after spaying and 8.5 mmol/L or by 2.3 times after 1 year as compared to the first measurement.

Results of the present study also demonstrated that removal of female gonads or ovaries leads to enormous changes of metabolism, especially lipid and cholesterol metabolism. Thus deeper disturbance of both lipid and carbohydrate metabolisms in ovariohysterectomized dogs ensures the process of intensive increase of the animal body mass.

We did not find any information on research of changes and disorders, occurred in metabolism after ovariohysterectomy of female dogs. Because there are extensive human medical studies on metabolic changes of women during deficiencies of reproductive hormones, citations were made from such studies.

In human medicine, surgical removal of ovaries or uterus occur broadly due to various genital organ disorders in women. In such cases, deficiencies of estrogens or progesterone hormones also occurred in female body. Changes in the body and complex

clinical symptoms as a whole is called post-oophorectomy syndrome. This syndrome includes three groups of disorders; neuro-vegetative, metabolic-endocrine and psychological-emotional.

Metabolic disorders caused by hypothalamic functions on the basis of estrogenic deficiency in women occur most commonly. Major factor determining this disorder is associated with enormous changes of insulin sensitivity and it causes insulin resistance in tissues and cells. Based on the former, stable increase of blood sugar and serious changes of lipid metabolism (cholesterol, triglyceride and low density lipid) are observed. Such metabolic disorder causes such complications as animal body weight gain, obesity, high blood pressure, atherosclerosis and cardiac ischemia. During mid level deficiency of estrogenic hormone, blood concentration of triglyceride and cholesterol LDL increase up to 200 to 500 mg/dl, 200 to 240 mg/dl and 130 to 160 mg/dl respectively, whereas during heavy deficiency of the hormone, they exceed 500 mg/dl, 240 mg/dl and 160 mg/dl respectively, according to study conducted by UNFPA (2010).

As informed about disorders due to surgical removal of ovaries in women by Smetnik and Tumilovich (2014), deficiency of estrogenic hormone resulted in loss of hormonal balance, serious metabolic disorder, especially deep changes in lipid metabolism, significant increase of blood clotting, stable increase of blood pressure, cardiac ischemia and atherosclerosis.

Our study revealed surgical removal of gonads from the body of mature female dog with normal reproductive functions also resulted in deficiency of sex hormones and deeper metabolic disorders. According to our study results, it can be associated with deliberate change of naturally close interrelated neurohumoral regulation via hypothalamus-pituitary gland-gonads axis, followed by breaking balance of sexual hormonal, organ and system functions, as well as serious disturbances of animal body metabolism and homeostasis.

CONCLUSION

1. Progesterone secretion in female puppy peaked (20-35 ng/ml) during diestrus, and the highest estradiol concentration (25-35 pg/ml) occurred in proestrus stage
2. After one year of ovariohysterectomy in female dog, its blood total proteins, albumin, total lipids, cholesterol and glucose concentrations
3. Surgical removal of gonads of female dogs after completion of their sexual maturity causes deep disorders of metabolism especially lipid and carbohydrate metabolism.

increased by 14%, 31%, 2.3, 3 and 2.3 times respectively.

REFERENCES

1. Valiullina, D.F, Development of method for electro-coagulation of oviduct in dogs, Autoreferate of ScD dissertation, Kazani, Russia, 2010,
2. Michael Richards “Spay canine” 2001
3. Prokofiev, M.I., Manipulation of farm animal reproduction, Moscow, 1983
4. Chuluunbaatar Sh., Non-globalized Mongolian Dog, UB, 2011
5. UNFPA, Diagnostic and Therapeutic Guidelines During Menopause, 2010
6. V.P.Smetnik and L.G.Tumilovich, Gynecological Diseases, 2010
7. <http://www.tc.umn.edu> Breeding management in the bitch.\