Chapter 5

5.0 DISCUSSION

5.1 PROGESTERONE AND OESTRADIOL LEVELS IN DIFFERENT GOAT GENOTYPES WITH DIFFERENT TYPES OF OESTROUS CYCLE (EXPERIMENT 1)

Duration of oestrous cycle length in the tropical goats were approximately 21 $\pm$ 3 days (Abdullah *et al.,* 1998). For the Katjang goats the average oestrous cycle length was 21.67 $\pm$ 0.82 days (Sharifah Nazari., 1989). Similar patterns of oestrous cycle length were observed in all the experimental animals used in the study regardless of the breed. Normal oestrous cycle length ranged between 19 to 22 days, 19 to 23 days and 19 to 22 days in Jermasia goats, Katjang goats and Boer crossbred goats, respectively. The detection of oestrus in the female goats was done by observing the behavioural patterns of the animals and also with the aid of a mature buck. The animals were said to have normal oestrous cycle when the oestrous cycle length was 21 $\pm$ 3 days. Among the three breeds studied, Jermasia goats had the highest percentage (90%) among the breeds with normal oestrous cycle followed by Katjang goats (60%) and Boer crossbred goats (30%)(Table 3). Abnormal oestrous cycle can be divided into long oestrous cycle and short oestrous cycle. From a total of 25 goats studied, only 40% of the animals showed abnormal oestrous

cycle. Long oestrous cycle comprised of five goats (20%). Four goats (40%) and only one goat (20%) from Boer crossbred goats and Katjang goat, respectively, showing long oestrous cycle and only one goat (40%) had short oestrous cycle, that is the Boer crossbred goat. A total of 16% of the goats that did not show the sign of oestrus. This was 10% of the Jermasia goats and 20% of the Katjang goats and Boer crossbred goats.

There are many factors that influence the oestrous cycle length of the goat. They include the age of the animals, temperature, nutrition and hormone activity. Some researchers found that the duration of oestrous cycle for the older animals were longer than the young animals (Symington and Oliver,1966). The abnormal oestrous cycle will affect the fertility of the female animals. For this group of animals, collection of blood samples were done from April 1998 until June 1998, that is during the hot and dry season in Malaysia, where foods were very limited. Undernutrition can also affect the capacity of the animal to reproduce satisfactory (Widdowson, 1981). Undernutrition reduces fertility in farm animals (Robinson, 1951; Robertson *et al.,* 1951). The effects vary from one species to another species and from one part of life and stage of reproduction to another. It may also be due to the heat stress and high temperature. Heat stress is a major contributing factor to the low fertility in animals inseminated in late summer month (Ingraham *et al.,* 1974). It was also suggested that heat stress reduces the duration and intensity of oestrus (Hansen, 1997; Nobel. *et al.,* 1997). This may also increase the incidence of anoestrus and silent ovulation (Gwazdauskas, 1981).

Data collected by many researchers from the temperate region of the world also gave the average value of normal oestrous cycle length of cattle approximately 21 and 22 days with range of from 18 to 25 days (Asdell, 1946; Chapman *et al.,* 1937). Goats and sheep in the temperate region of the world are termed as seasonal polyoestrous, that is they have a series of oestrous cycle at certain season of the year. Then their reproductive activity ceases for a period of time (Davendra and Burns, 1970). Oestrous cycle is controlled by the interaction between the reproductive hormones such as progesterone (P_4) and oestradiol (E_2) from the ovary with the gonadotrophic hormones such as follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the pituitary gland (Asdell, 1946). Among the goats with 19 days oestrous cycle, progesterone levels in Jermasia goats started rising on day 1, in Katjang goats on day 3, but only starting to rise on day 10 for Boer crossbred goats. In both Jermasia and Katjang goats with 21 days oestrous cycle , progesterone levels started to rise from day 3, whereas in goats with 22 days of oestrous cycle, progesterone levels rose on day 3 of oestrous cycle. The increased in progesterone levels occurred shortly after oestrus and the intermediate period between oestrus and dioestrus was known as metoestrus period. At this stage, the ovaries contain corpus haemorrhagicum and then the corpus luteum developed. Progesterone levels started to increase although the lutuem tissue was not completely developed. After ovulation, there was an immediate declined in the oestrogen levels. It was probably due to the ruptured follicle

became transformed into a corpus haemorrhagicum and then the corpus luteum developed, to secrete progesterone.

The progesterone level was gradually increasing and reached the peak on day 11 (7.93 ng/ml), on day 12 (3.42 ng/ml) and day 16 (1.29 ng/ml) for Katjang, Jermasia and Boer crossbred goats (with 19 days oestrous cycle), respectively. At this stage, corpus luteum had fully developed and the progesterone became the main hormone secreted from the ovary. The effect of progesterone on the pituitary was to minimize its secretory activity and the animal is said to be in a state of dioestrus. The oestradiol levels remained low throughout the dioestrus period for all the three genotypes. If fertilization did not occur, the corpus luteum normally remained functional for only a short period. Prostaglandin is produced by the uterus and under its influence the corpus luteum regressed very rapidly and subsequently ceased to secrete progesterone. It was shown by a drop in the progesterone level and increased in oestradiol level. This phase was known as proestrus that is the period just before oestrus. The decrease in progesterone level stimulated the pituitary to release FSH. The follicle-stimulating hormone stimulated the growth of ovarian follicles. FSH had a stimulatory effect on the nuclear and cytoplasmic maturation of the oocytes (Schoevers *et al.*, 2003). As the follicle grew and became mature, oestrogen began to be actively secreted oestrogen. Oestradiol levels reached the peaks only on days closest to oestrus which were prior to day 0 and then started to decline from then onwards. The high level of oestrogen in the blood before the onset of the oestrus acted to prevent a greater

release of FSH and to promote release of LH. A large quantity of LH appeared as a peak very rapidly and declined again all within 4 to 6 hours. The presence of this LH peak in the circulation was the signal to the highly-developed follicle to complete the process of ovulation (Evans and Maxwell, 1987). At this stage the animal is said to be in the oestrus phase.

Abnormal oestrous cycle in the female animal may be as a result of unsynchronous interactions between the reproductive hormones (Abdullah and Nazari,1990). In this studies, goats which showed long oestrous cycle and short oestrous cycle showed the same hormonal pattern as seen in animals with normal oestrous cycle. But instead of that, it was observed that goats with long oestrous cycle showed longer dioestrus period whereas goats with shortest oestrous cycle had the shortest dioestrus period. So, it can be said that the abnormal oestrous cycle observed in the animals is not the result of unsynchronous interactions between the reproductive hormones.· It is actually determined by the length of the dioestrus period. Data collected by the other researcher also showed that the duration of oestrous cycle depend on the development of the corpus luteum (Asdell ,1946). The length of the oestrous cycle is determined by the length of the period of dioestrus (Lindsay *et al.*, 1982). Among the anoestrus female, a single individual was observed to have male characteristics comprising of build and behaviour. Hormone profile of this individual showed undetectable progesterone levels and extremely high oestradiol levels whereas in the other anoestrus goat, average daily variation showed alternating peaks of oestradiol and progesterone but for most of the

duration, oestradiol levels were higher (Figure 38). The pattern of hormone profile in the anoestrus goats suggested that it may be a result of unsynchronous interactions between the reproductive hormones. In many studies done by researchers showed that oestrogen levels were found to be higher in animals without a CL, suggesting that oestrogen levels elevated for period longer than those occurring during the normal oestrous cycle may result in abnormal follicular development thus affect the conception rate.(Menegatos, *et al.,* 1995). The failure of animals to show signs of oestrus, is the major constraint to a broader option of AI for genetic improvement in the animal (Baruselli, 2001). In an attempt to overcome the difficulty, we may use various protocols to synchronize oestrus and ovulation in the anoestrus goats. It was reported that treatment with redesignated intravaginal progesterone insert with FSH at insert removal, stimulated fertile oestrus and resulted in prolificacy in anoestrus animals (Knights *et al.,* 2000).

5.2 PROGESTERONE AND OESTRADIOL LEVELS 2 DAYS BEFORE OESTRUS UNTIL 2 DAYS AFTER OESTRUS FOR JERMASIA GOATS WITH NORMAL OESTROUS CYCLE (INTENSIVE STUDY- EVERY 8 HOURS) (EXPERIMENT 2)

Progesterone levels started declining two days prior to oestrus. Soon after the decline of progesterone level, oestradiol level started to rise (Table 9). The declining trend in progesterone levels before oestrus indicates the regression of the corpus luteum. The low levels of progesterone hormone, stimulates the pituitary to release FSH and the FSH stimulates the growth of ovarian follicles until it becomes matures follicles. As the follicles develop they begin actively secreting oestrogen. This is shown by the increasing in the oestradiol levels on day -2 at 1500 hours. The oestradiol levels increased gradually until it reached the peak on day -1 at 0700 hours. The peak in oestradiol levels may indicate that the ovarian follicles are fully-grown. The high level of oestrogen in the blood promotes release of LH. The presence of this LH peak in the circulation is the signal to the highly-developed follicle to complete the process of ovulation (Evans and Maxwell, 1987). Oestrus was detected on day 0 at 0700 hours. The detection of oestrus in the female goats was also done by observing the behavioural patterns of the animals and also with the aid of a mature buck. Data collected by the other researchers shows that the peak of oestrogen level occurs just before the onset of the oestrous and is followed by ovulation 18 to 24 hours later (Evan and Maxwell, 1987). It

was observed that the period between the oestradiol peak (2.62 pg/ml) on day -1 at 0700 hours and the detection of oestrus on day 0 at 0700 hours, is about 24 hours (Figure 28). Therefore, it can be predicted that the ovulation happened 18 to 24 hours later after the onset of the oestrus that is between day 0 at 2500 hours and day 0 at 0700 hours. The oestradiol level at this point decreased to undetectable level (0.00 pg/ml) indicating the rupture of the follicle. The ruptured follicle transformed into a corpus haemorrhagicum and then the corpus luteum developed. At this stage progesterone becomes the main hormone secreted from the ovary and it can be seen that on day 1 at 2300 hours the progesterone levels started to increase.

5.3 PROGESTERONE AND OESTRADIOL LEVELS IN DIFFERENT GOAT GENOTYPES AFTER OESTRUS SYNCHRONIZATION (EXPERIMENT 3)

In any group of mature animals, the normal oestrous cycle are distributed at random. Effort to control the reproductive cycle are design to synchronize the time of oestrus so that mating and insemination can be carried out at a predetermined time. Several methods were used for oestrous synchronization and the approached we used for oestrous synchronization for the goats is by extending the length of the luteal phase of the oestrous cycle using a vaginal progesterone implant. When CIDR implant was inserted on day 2, the blood analysis showed that progesterone levels started to rise immediately after implantation (Figure 24). This is because the CIDR device contains a natural hormone progesterone and once it is inserted into the vagina, it will slowly released the progesterone. The progesterone levels were then maintained throughout the whole experiment until the CIDR was removed from the animals after 19 days of blood collection. Serum progesterone concentrations during the subsequent cycle were higher than those reported for the natural oestrous cycle (Menegatos, *et al.,* 1995). The high levels of progesterone acts as if the corpus luteum is still active thus prevents the release of FSH from the pituitary gland. The low levels of FSH in the blood inhibits the growth of ovarian follicles thus preventing oestrus and ovulation in the treated animals. Oestrous cycle activity does not occur until growing and maturing follicles appear in the ovaries (Asdell, 1946 and Hammond, 1955). When the CIDR implant was removed from the animals, the progesterone levels started to decline

from 6.48 to 2.55 pg/ml, 2.54 to 0.01 pg/ml and 2.56 to 0.02 pg/ml in Jermasia goats, Boer crossbred goats and in Mixed breed goats, respectively. The low level of progesterone hormone sparks off a new wave of follicular development. It stimulates the pituitary to release FSH and the FSH stimulate the growth of ovarian follicles until it becomes matures follicles. At this stage, ovum is then released from the ovary. It was reported that there was a different in the time of oestrus and ovulation for the same genotype depending on the dosage of progesterone used in sponges (Robinson, 1966). Some animals exhibit oestrus and ovulation commences within 36 and 48 hour for 10 mg doses and up to 60 hours for the 20 mg doses. The research done showed that nearly all animals exhibit oestrus within 3 to 6 days after the removal of the CIDR implant (Zimbleman, 1966). It was observed that all the animals used in this study showed the sign of oestrus 24 hours to 72 hours after the removal of the CIDR implant. The longer hours to show the sign of oestrus may be due to the same dosage of progesterone were used for animals at different age and different body weight. Even if a good synchronization of oestrus is obtained, conception rate of animals undergoing a synchronized oestrus is generally lower than that of normally cycling animals when animals are mated or inseminated (Zimbleman, 1966). The main reasons for the reduction in fertility have not yet unknown, but there was a clear effect of type of progestagens used and different dosage of progestagens used were responsible for the lower conception rate in animals (Robinson, 1966). The present study has shown that different synchronization protocol, different type and dosage of progestagen used, will give different results in the conception rate in the animals (Robinson, 1966; Gianluca Neglia *et al.*, 2003). In another study which involved animals induced to

ovulate by mean of progestin treatment, showed that the presence of the corpus luteum (progesterone concentration > 0.5 ng/ml) during the period of oestrus synchronization treatment improves the pregnancy rate (Sanchez, *et al.*, 1993).