Increasing Goat Productivity Through the Improvement of Endogenous Secretion of Pregnant Hormones Using Follicle Stimulating Hormone

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Abstract. Previous studies reported that the improvement of endogenous estrogen and progesterone secretions during gestation improved fetal prenatal growth, birth weight, mammary gland growth and development, milk production, litter size, pre- and post-weaning growths. An experiment was conducted to apply the improvement of endogenous secretion of pregnant hormones during pregnancy to increase goat productivity. Thirty-six female ettawah-cross does were divided into 2 groups. Group 1 (control: 18 does) included does without improvement of endogenous secretion of pregnant hormones and Group 2 (treatment: 18 does) included does with improvement of endogenous secretion of pregnant hormones using follicle stimulating hormones to stimulate super ovulation. The application of this technology increased total offspring born (control: 25 offspring; treatment: 42 offspring), average litter size (control: 1.88; treatment: 2.33), offspring birth weight (control: 2.85±0.50 kg; treatment: 3.82±0.40 kg), and does milk production (control: 1.36±0.34 L/does/day; treatment: 2.10±0.21 L/does/day). Offspring born to does with improved endogenous secretion of pregnant hormones had better weaning weight (control: 11.17±1.99 kg/offspring; treatment: 14.5±1.11 kg/offspring). At weaning period, does with improved endogenous secretion of pregnant hormones produced offspring with total weaning weight twice as heavy as control does (control: 189.9 kg; treatment: 403.6 kg). By a simple calculation of economic analysis, this technology application could increase gross revenue per does until weaning by Rp. 432.888,89. It was concluded that this technology is economically feasible to be applied in small-scale farm.

Key Words: follicle stimulating hormone, pregnant hormones, endogenous secretion, super ovulation, ettawah-cross does.

Introduction

Low animal production especially mammals in Indonesia was assumed to be due to the low population of productive females and low reproductive efficiency (Kementan, 2010). Offsprings produced by productive females have low birth weight, high mortality during pre-weaning period with low growth performance during post-weaning period (Manalu et al., 1996; Adriani et al., 2004). This low growth performance is due to low offspring birth weight and does milk production during lactation as the consequence of low prenatal growth of the fetus and low mammary gland growth and development during pregnancy (Manalu et al., 1995; Mege et al., 2007). The low fetal growth and mammary gland growth as well as development during pregnancy are assumed to relate to low endogenous secretions of pregnant hormones (De Feu et al., 2008; Demetrio et al., 2009; Dupras et al., 2010).

The previous studies in sheep and goats showed that low prenatal growth, low growth and development of the mammary gland during gestation period were caused by the imbalance and the low ratio between the hormones of gestation and the number of offspring conceived (Manalu et al., 1995). Increased number of ovulating follicles and corpus luteum could increase secretion of estrogen and progesterone as the main pregnancy hormones (Manalu and Sumaryadi, 1995; Mege et al., 2007). Increased secretion of endogenous

pregnant hormones gives the final result of improved embryo and fetal growth during gestation and improved birth weight at parturition (Sumaryadi and Manalu, 1995; Adriani et al., 2007; Mege et al., 2007). The improved secretion of endogenous pregnant hormones drastically improves mammary gland growth and development during gestation that ultimately improves milk production during lactation (Sumaryadi and Manalu, 1995; Manalu et al., 1996; Manalu et al., 1997; Manalu et al., 2000). Improved birth weight at parturition and milk production during lactation increases growth and survival of offsprings before weaning (Manalu et al., 1997; Manalu and Sumaryadi, 1998; Sumaryadi and Manalu, 2001). This study was designed to analyze economical and technical feasibility of super ovulation application to improve goat's productivity in small-scale goat farm.

Materials and Methods

Thirty-six ettawah-cross does aged around 15 months (sexually mature) were used in this experiment. The experimental does were assigned into a completely randomized design with two treatments. Group 1 (control: 18 does) included does without improved secretion of endogenous pregnant hormones technology and Group 2 (treatment: 18 does) included does with improved secretion of endogenous pregnant hormones technology by super ovulation. Before the experiment, the female ettawah-cross does were administered anthelminthic, multivitamins, and antibiotics.

Before mating, the experimental does were injected with prostaglandin (Noroprost® from Norbrook with dose of 12.5 mg/does), twice with 11 days interval, to synchronize estrous cycle. On days 9 and 10 after the first prostaglandin injection, the treatment does were injected with FSH (Fertagyl® from Intervet, 0.2 mg/does) to stimulate super ovulation. Twenty four to 36 hours after the second prostaglandin injection, the experimental does were mixed with boars (with ratio 1:7) for natural mating. After mating, the experimental does were maintained in group until parturition.

The number of embryo carried by the experimental does in the first month and the number of surviving fetus in the third month of pregnancy were counted by ultrasonography (USG). After parturition, litter size, offspring birth weight, number of offspring weaned, weaning weight, and pre-weaning offspring mortality were measured. Milk production was measured at the peak of the lactation period. From the data collected, the ratio and total birth weight of offspring per doe, and total weaning weight were calculated. The data were analyzed by analysis of variance (ANOVA). Using the input (prostaglandin and FSH) and output (surviving offspring until weaning) prices during the experiment, gross revenue were calculated to analyze simple economic feasibility from implementation of this technology.

Results and Discussion

The ettawah-cross does receiving super ovulation technology to improve endogenous secretion of pregnant hormones during pregnancy (treatment) had higher number of embryo (at the first month of pregnancy), higher fetus (at the third month of pregnancy), lower percentage of fetal mortality, and higher number of kids born at parturition as compared to control does (Table 1).

At parturition, the number of offspring born, ratio of offspring per doe, average birth weight, and total birth weight were dramatically improved in super ovulated does. The increased litter size did not decrease birth weight (Table 2). Pre-weaning mortality percentage was significantly lower in super ovulated does compared to the control ones. The pre-weaning mortality was higher in does having 3 and 4 litter sizes. At the peak of lactation, milk

production in the super ovulated does increased 54.41% compared to the control does. At weaning, does receiving super ovulation treatment had higher number of offspring weaned with heavier weaning weight and consequently higher total weaning weight.

These data indicated that total productivity of super ovulated does was twice as many as control does. This improved productivity only required input of prostaglandin and FSH. Simple economic analysis showed that the application of super ovulation technology could double gross revenue per does (Rp. 764.888.89,00 in super ovulated does vs. Rp. 332.000,00 in control does) (Table 3).

The results of this present study confirmed that the increased secretion of endogenous pregnant hormones during pregnancy improved the growth of embryo, fetal birth weight (Sumaryadi and Manalu 1995; Adriani et al. 2007; Mege et al. 2007), and mammary gland growth and its development as indicated by the improved milk production (Sumaryadi and Manalu, 1995; Manalu et al., 1996; Manalu et al., 1997; Manalu et al., 2000). Improved birth weight at parturition and milk production during lactation increased growth and survival of offspring before weaning (Manalu et al. 1997; Manalu and Sumaryadi, 1998; Sumaryadi and Manalu, 2001).

The results of this super ovulation technology application strongly indicated its potential to be used to improve domestic animal production with local breeds. The data indicated that super ovulation technology clearly improved growth performances of offspring from post partum to weaning. This method could be applied to improve offspring production for fattening. The data obtained in this study strongly recommended the feasibility of this technology application in sheep, swine, beef, buffalo, and other local or domestic mammals to increase domestic meat production and to reduce cattle import (Kementan, 2010). The milk production data also indicated that this technology could be applied in dairy cows, dairy goats, and buffalo to improved domestic milk production and to reduce milk import.

In 2009, Indonesia imported 1.1 million cattle and in 2007 milk import reached 1.3 million tons (Sabana, 2007). In addition, domestic demand for sheep and goats increased. During 2007, domestic sheep and goats demands for *Iedul Qurban* reached 4.5 million heads and increased to 5.6 million heads in 2008 (Dirjennak, 2007). These demands excluded the regular market demands for daily

Table 1. The embryo and fetal number of control and super ovulated ettawah-cross does in the first and third months of pregnancy.

	Control does	**Super ovulated does**
The number of embryo (first month of pregnancy)	32	52
1	6	1
2	8	6
3	3	5
4	1	6
The number of fetus (third month of pregnancy)	25	42
1	11	1
2	5	11
3	2	5
4	0	1
The number of offspring born at parturition	25	42
Prenatal mortality	7 (21.88%)	10 (19.23%)

Table 2. Productivity of control and super ovulated does as indicated by litter size, birth weight, pre-weaning mortality, number of offspring weaned and weaning weight, and milk production.

	Control does n=18	Superovulated does n=18
Litter size (head)	1.88	2.33
Total of offspring born (head)	25	42
Average birth weight (kg/head)	2.85±0.50	3.82±0.40[a]
Total birth weight (kg/18 does)	5.36	8.90
Total of weaning offspring (head/18 does)	17	27
Average of weaning weight (kg/head)	11.17±1.99	14.95±1.11[a]
Total weaning weight from 18 does (kg)	189.9	403.6
Pre-weaning mortality (n,%)	8 (32.00)	15 (35.71)
Average milk production (L/head/day)	1.36±0.34	2.10±0.21[a]

Values bearing different superscript at the same row differ significantly (P<0.05).

Table 3. Simple economic analysis of super ovulation technology application in improvement of goat productivity at weaning period.

	Control does n=18	Superovulated does n=18
Total weaning weight (kg per 18 does)	189.9	403.6
Live weight price (Rp per kg)	40,000	40,000
Gross revenue (Rp)	7,596,000	16,144,000
Operational cost (Rp)		
a. Estrous synchronization (@ Rp90,000.00)	1,620,000	1,620,000
b. Super ovulation (@ Rp42,000.00)	0	756,000
Gross profit (Rp)	5,976,000	13,768,000
Gross profit per does at weaning period (Rp)	332,000	764,888.89
Profit increase by application of technology (Rp per does)	432,888.89	

consumption. The improved local animal productivities could support the domestic animal production, especially sheep and goats, to meet the international market demand. South East Asia and the Middle East market need about 9.3 million sheep per year (Kementan, 2010).

Conclusion

The application of super ovulation technology to improve endogenous secretions of pregnant hormones increased offspring productivity and gross revenue in the small-scale farm.

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