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Reproductive Performance of Saanen Goats After PGF2α Intramuscular Injection in Correlation to Body Weight

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Abstract. An experiment was conducted at Kalikesur Farm, Kedung Banteng, Banyumas to investigate the reproductive performance of Saanen dairy goats after PGF2α injection on different body weights. This experiment included twenty female Saanen goats at 2-3 years of age, 2-3 kidding periods, and varying body weights of 30 to 55 kg. All goats were intramuscularly injected by 2 ml PGF2α (LutalyseTM, Pharmacia and Upjohn Company, Pfizer Inc) in a double injection pattern, with 11-day interval to perform estrous synchronization. The variables on reproductive performance such as estrus onset, length of estrus, and intensity of estrus were measured and monitored twice a day at 6-10 am and 3-5 pm. Descriptive statistics and correlation analysis were conducted. Results demonstrated that body weight performed strong correlations with estrus intensity (r = 0.66) while the time for the first estrus (onset) has a negative moderate correlation with body weight (r = -0.47), a negative weak correlation was recorded between body weight and length of estrus (r = -0.17). Based on the results obtained, it can be concluded that the body weight of goats in the estrus synchronization program can be used to be an indicator of reproductive performance, especially in estrus intensity. This can help farmers to predict estrus behavior after PGF2α synchronization.

Keywords: body weight,estrus, Saanen goat

Abstrak. Penelitian dilakukan di Peternakan Kalikesur, Kedungbanteng, Banyumas untuk mengetahui performans reproduksi kambing perah Saanen setelah penyuntikan PGF2α pada bobot badan yang berbeda. Penelitian ini menggunakan dua puluh ekor kambing Saanen betina umur 2-3 tahun, dengan paritas 2-3 dan bobot badan bervariasi antara 30-55 kg. Kambing diinjeksi secara intramuskular dengan 2 ml PGF2α (LutalyseTM, Pharmacia and Upjohn Company, Pfizer Inc) dengan pola injeksi ganda dan interval 11 hari untuk melakukan sinkronisasi estrus. Variabel kinerja reproduksi seperti onset, lama estrus dan intensitas estrus diukur dan dipantau dua kali sehari pada pukul 6-10 pagi dan 3-5 sore. Statistik deskriptif dan analisis korelasi dilakukan. Hasil penelitian menunjukkan bahwa bobot badan berkorelasi kuat dengan intensitas estrus (r = 0,66) sedangkan waktu estrus pertama (onset) berkorelasi negatif sedang dengan bobot badan (r = -0,47), korelasi lemah negatif tercatat antara bobot badan dan lama estrus (r = -0,17). Berdasarkan hasil yang diperoleh dapat disimpulkan bahwa bobot badan kambing pada program sinkronisasi estrus dapat dijadikan sebagai salah satu indikator kinerja reproduksi khususnya pada intensitas estrus. Hal ini dapat membantu peternak untuk memprediksi gejala estrus setelah sinkronisasi PGF2α.

Kata Kunci: bobot badan, estrus, Kambing Saanen

Introduction

Developments of the animal reproduction technology made a significant progress, especially in hormones manipulation. The impacts of this development are shortened of time for mating and improved reproduction efficiencies. One of the methods for improving reproduction efficiencies is by modifying the estrus cycle in such a way that reproduction can be adapted according to the purpose of the livestock production. Estrus cycle modification by synchronizing the estrus is commonly used to make cheaper and easier breeding program, improve reproductive function, and shorten the breeding season (Stevenson and Britt, 2017; Parmar et al., 2020).

Progesterone and estrogen are the most used methods for estrus synchronization. These two hormones are very commonly applied to many smallholder farmers to an industrial scale. However, for the most economical price, simple application, and high reproductive performance, estrus synchronization is using prostaglandin in the form of prostaglandin F2 alpha (Fauzi et al., 2017; Hasani et al., 2018). The hormone is stimulating and synchronizing estrus due to

corpus luteum luteolysis (Cuervo and Newcombe, 2010) and as a result, the block of progesterone produced by CL against gonadotropin hormone is lost, which eventually result in follicular growth and maturation (Feradis, 2010; Hou et al., 2008; Toelihere, 1985).

Reproductive performance is highly varied in goats (Romano, 1993); it is depending on season, breed, breeding system and food availability (Khan et al., 2008). Factors affecting reproductive performance are associated to either to the management factors (such as methods of husbandry, feeding, estrus detection, semen handling and transition cow management) or to the cow factors (such as age, body condition score, postparturient problem, disease events, milk yield, and genetics) (Hudson et al., 2012). Food availability with sufficient nutrition produces appropriate body weight which supports the reproductive performance of livestock. Muktiani and Kusumanti (2017) concluded that the addition of high protein supplement could increase body weight and as a result it will improve the estrus performance in goats. Therefore, the aim of this study was to investigate the correlation between body weight and reproductive performance including estrus onset, length of estrus and intensity of estrus.

Materials and Methods

This study was conducted during May to November 2021. Twenty Saanen goats were used in this study with average body weight of 30-55 kg and having second to third kidding period. The goats were kept in an intensive system which originated from farmer in Kalikesur Kedung Banteng, Banyumas. Those goats were treated with two times dosage, 2 ml of PGF2α (Lutalyse™, Pharmacia and Upjohn Company, Pfizer Inc) each with 11-day interval.

A day after injection, the observed variable was monitored. Those are: 1) the onset of estrus, i.e. the time required by goats to show first signs of estrus after treatment; 2) length of estrus, i.e. the period of time for goats of showing estrus signs which is counted from the start of showing first symptoms of estrus to the end of estrus; 3) intensity of estrus, i.e. performed by scoring criteria. Observation of estrus was carried out twice per day at 6-10 am, and 3-5 pm. The observation technique was carried out visually and assisted by a male goat.

Variable of the research, i.e. intensity estrus observation was based on estrus performance that arose according to the set score. Criteria for scores on intensity estrus were presented on Table 1. Scores of estrus intensity was assessed with a rating of 0 to 3. A low score indicates that estrus is increasingly unobservable, on the contrary, a higher number indicates that estrus is very clear to observe.

The data collected for this study were analyzed according to the research objectives. Most of the cases descriptive statistics such as number, percentage distribution, mean, standard deviation were calculated. Pearson correlation coefficient was also computed using Excel® 2013 to know the strength of correlation between variables.

Table 1. Scores of estrus intensity

Scores	Criteria
0	does not show estrus performance
1	less clear estrus with signs, the vulva is slightly red and swollen, no mucus, and no showing performance of silence when mounted by a ram
2	estrus looks moderate with vulvar signs red, swollen, a little mucus, and mounting other females
3	estrus looks very clear with red vulvar markings and swollen, a lot of mucus, and silent when climbed other goats

Results and Discussion

Data of reproductive performance of twenty Saanen female goats which consist of onset, length and intensity of estrus is present on Table 2.

Table 2. Mean of Saanen reproductive performance after PGF2α injection in different body weight

Body weight (kg)	Estrus onset (hours)	Length of estrus (hours)	Estrus Intensity (score)
30.00 - 35.00	55.43	149.68	2
35.01 - 40.00	33.26	111.17	2.5
40.01 - 45.00	26.92	94.50	3
45.01 – 50.00	31.35	124.72	3

Estrus Onset

Estrus onset on this experiment showed that the first time for Saanen goats performs estrus behavior were varied. The fastest onset of estrus was found in goats with 40.01 – 45.00 kg of body weight, and the body weight has negative moderate correlation (r = -0.47). Onset of estrus is affected by prostaglandin hormone. After injection by PGF2α, goats which having matured Corpus Luteum (CL) will perform estrus due to the lysis of CL. PGF2α injection as prostaglandin analog which is produced by uterus can lyse matured CL due to the *vasoconstriction mechanism* with the result of decreasing blood flow to CL in the ovary (Sinda *et al*., 2017). Based on the coefficient correlation analysis, in estrus synchronization protocol, body weight can be used to predict onset of estrus. Body weight is still one of the important parameters for selection program (Cam et al., 2010) and become one of the important factors in determining potential production.

Sufficient nutrition in goats will enable the animal to achieve the appropriate body weight. Nutritional sufficiency will cause all glands in the body to function better (Hafez and Hafez, 2000). In estrus, one of the glands that becomes target is the anterior pituitary gland. Increasing function of the pituitary gland, followed by increase in hormone secretion gonadotropins, FSH and LH will result in estradiol secretion (Adam *et al.*, 1994).

Length of Estrus

Result in this study showed that the longest time for estrus was showed in goats with the lowest body weight (30 – 35 kg), and the length of estrus varied between 94 - 149 hours. Furthermore, a weak negative correlation between body weight and length of estrus (r = -0.17) was observed in this study. The length of estrus in this study differed with the previous experiments which reported length goat estrus is 36 hours and varies between 24 to 48 hours, while ovulation occurs between 9 and 37 hours from onset of estrus (Fatet et al., 2011). Toelihere (1985) stated that the variation in the length of estrus for goats may be due to breed, rearing management, age, season, temperature and the method of observation used. Dewi et al. (2011) concluded that the length of estrus in animals can be altered by LH surge. Early LH surge during estrus due to high concentrations of estrogen in the blood will affect the prolonged estrus time. Differences length of estrus is also affected by different number and maturity of follicles in the ovary. Length of estrus is controlled by existence of estradiol in blood, which produced by follicle (Sinda et al., 2017).

Intensity of Estrus

The intensity of estrus or the degree of appearance of estrus is a signal that distinguishes the appearance of estrus shown by the animals. Observation of estrus behaviour consists of a silent ride, redness of the vulvar mucosa, vulvar swelling, and mucus viscosity which are quantified in score (Santoso et al, 2014). The highest estrus intensity in this study, was shown by the score of 3 (estrus looks very clear with red vulvar markings and swollen, a lot of mucus, and silent when climbed other goats), which were observed in goats with 40 – 50 kg of body weight. The strong positive correlation was observed between body weight and estrus intensity (r = 0.66).

According to Partodiharjo (1980) nutritional stage of animals affected estrus intensity and this is related to the mechanism of reproduction hormone. Deficiencies of nutrient in goats lead to low body condition score which affect hypofunction of reproduction glands and hormone secretion (Dewi et al., 2011)

This study result showed that the estrus intensity is high. It is most likely because of the FSH secretion; thus, the follicles formation process is undergoing well. Higher follicle development results in more mature Graafian follicle which eventually secretes estrogen. This condition has an impact to the high blood supply in genital tract. Cell activities in the vaginal area increases, therefore vulva is changing color to reddish, increasing temperature and swelling (Rasad *et al*., 2017)

Conclusions

Based on the results of the study, it was concluded that body weight had effect on reproductive performance of Saanen goats. However, there are other factors that affect reproductive performance such as nutritional balance, environment and genetics. Overall reproductive performance of Saanen goats at Kalikesur Farm, Kedungbanteng Banyumas are within the acceptable level.

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References

Adams NR, JA Abordi, JR Briegel, and MR Sanders. 1994. Effect of diet on the clearance of estradiol-17-beta in the ewe. J. Biol. Reprod. 51:668-674

Adam M, RN Huda, W Zahara, TN Siregar, S Wahyuni, CN Thasmi, and Rosmaidar. 2018. Perbandingan Kinerja Berahi dan Level Estradiol Kambing Kacang dan Kambing Nubian yang Diinduksi dengan PGF2α. Jurnal Sain Veteriner. 36(1): 32- 39. https://doi.org/10.22146/jsv.38444.

Cam MA, M Olfaz and E Soydan. 2010. Body measurements reflect body weights and carcass yields in Karayaka sheep. Asian Journal of Animal Veterinary Advances 5:120-127.

Cuervo-Arango J, JR Newcombe. 2010. Cloprostenol in equine reproductive practice: 304 something more than a luteolytic drug. Reprod Domest Anim. 45(5):e8–e11.

Dewi RR, Wahyuningsih and DT Widayati. 2011. Respon estrus pada kambing Peranakan Ettawa dengan body condition score 2 dan 3 terhadap kombinasi implant controlled internal drug release jangka pendek dengan injeksi prostaglandin F2 alpha. Jurnal Kedokteran Hewan. 5(1):11-16.

Fauzi MR, Suyadi, and T Susilawati. 2017. Pengaruh Pemberian Prostaglandin F2 Alpha Terhadap Waktu Kemunculan Birahi dan Keberhasilan Inseminasi Buatan Sapi Brahman Cross (Bx) Heifers. Jurnal Ilmu-Ilmu Peternakan. 27(3): 39–43.

Feradis, 2010. Bioteknologi Reproduksi Pada Ternak. Cetakan Kesatu. Hal. 115-119. Bandung: Penerbit Alfabeta.

Hafez ESE, B Hafez. 2000. Reproduction in farm animal's. Ed ke-7. Philadelphia: Lea and Febigher

Hou X, EW Arvisais, C Jiang, D Chen, SK Roy, JL Pate, TR Hansen, BR Rueda, and JS Davis. 2008. Prostaglandin F2 alpha stimulates the expression and secretion of transforming growth factor B1 via induction of the early growth response 1 gene (EGR1) in the bovine corpus luteum. Molecular Endocrinology. 22(2): 403-414.

Hudson CD, AJ Bradley, JE Breen, and MJ Green. 2102. Associations between udder health and reproductive performance in United Kingdom dairy cows. Journal of Dairy Science. 95: 3683–3697.

Ismail M. 2009. Onset Dan Intensitas Estrus Kambing Pada Umur Yang Berbeda. J. Agroland. 16 (2): 180-186.

Khan MS, MA Khan, and S Mahmood. 2008. Genetic resources and diversity in Pakistani goats. Int J Agric Biol. 10: 227–231

Muktiani A. and E Kusumanti. 2017. Pengaruh Pemberian Bungkil Kedelai Dan Suplementasi Zinc, Selenium Dan Vitamin E Terhadap Penampilan Estrus Pada Kambing Peranakan Etawah (The Effect Of Supplementation With Soybean Meal, Minerals And Vitamins On Estrus Performance Of Etawah Crossbreed Goats). Jurnal

Pengembangan Penyuluhan Pertanian. Vol. 14 No 25. http://jurnal.polbangtanyoma.ac.id/index.php/jp3/article/view/51.

Parmar CP, AJ Dhami, JA Patel, and VP Belsare. 2020. Efficiency of different estrus synchronization protocols in surti goats. Ind. J. Vet. Sci. Biotech. 15 (03) https://doi. org/10.21887/ijvsbt.15.3.6.

Partodihardjo S. 1980. Ilmu Reproduksi Hewan. Mutiara, Jakarta

Rasad SD and R Setiawan. 2017. Cytological characteristics of mucose cell and vaginal temperature and pH during estrous cycle in local sheep. Animal Production. 19: 21-27.

Romano JE. 1993. Effect of service on estrus duration in dairy goats. Theriogenology. 40: 77–84

Sinda SMW, TM Hine, and WM Nalley. 2017. Tampilan Estrus Dan Tingkat Keberhasilan Inseminasi Buatan Kambing Kacang Yang Diinduksi Menggunakan Prostaglandin F2α (Estrontm Bioveta) Dengan Dosis Yang Berbeda. Jurnal Nukleus Peternakan (Desember 2017). Volume 4, No. 2:163 – 172

Siregar TS. 2009. Profil Hormon Estrogen Dan Progesteron Pada Siklus Berahi Kambing Lokal. J. Ked. Hewan. Vol. 3 No. 2 September 2009

Stevenson, JS and JH Britt. 2017. A 100-Year Review: practical female reproductive management. J. Dairy Sci. 100 (12), 10292–10313. https://doi.org/10.3168/jds.2017-2959.

Tagama TR. 1995. Pengaruh Hormon Estrogen, Progesteron dan Prostaglandin F2α terhadap Aktivitas Berahi Sapi PO Dara. Fakultas Peternakan Universitas Jendral Sudirman. Purwokerto

Toelihere MR. 1985. Fisiologi Reproduksi Pada Ternak. Hal. 187-192. Bandung: Penerbit Angkasa