GROWTH RESPONSE OF BUFFALOES TREATED WITH OESTRADIOL 17 ß

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ABSTRAK

MAHYUDDIN, P. 1995. Respon pertumbuhan kerbau yang diperlakukan dengan estradiol 17 ß. *Jurnal Ilmu Ternak dan Veteriner* 1 (2): 89-93.

Pengaruh estradiol 17 ß dicobakan pada 10 ekor kerbau dengan rataan bobot badan 242 kg. Ternak-ternak tersebut diberi rumput gajah *ad libitum* dan pakan konsentrat sebanyak 1% bobot badan, dan secara acak dibagi dalam 2 kelompok, masing-masing terdiri dari 5 ekor, yaitu kelompok perlakuan dan kelompok kontrol. Kelompok perlakuan diimplantasi telinganya dengan karet silikon yang mengandung estradiol beraktivitas lama, selama 200 hari. Kerbau yang diperlakukan dengan estradiol menunjukkan kenaikan bobot badan (0,89 vs 0,68 kg/h) dan nisbah konversi pakan (9,2 vs 11,2) yang nyata. Penggunaan pemacu pertumbuhan (*growth promotant*) ini secara ekonomis menguntungkan.

Kata kunci: Estradiol, nisbah konversi pakan, kerbau

ABSTRACT

MAHYUDDIN, P. 1995. Growth response of buffaloes treated with oestradiol 17 ß. *Jurnal Ilmu Ternak dan Veteriner* 1 (2): 89-93.

The effect of oestradiol 17 ß was tested in 10 buffaloes, weighing approximately 242 kg. They were fed elephant grass *ad libitum* plus concentrate feed at a rate of 1% body weight, and were randomly divided into 2 groups of 5, the treated and control groups. The treated group animals were implanted with a long acting oestradiol-silicone rubber on the left ear for 200 days. Oestradiol treated-buffaloes showed a significant increase in liveweight gain (0.89 vs 0.68 kg/d) and feed conversion ratio (9.2 vs 11.2). Certainly it has a significant economic advantage in using this growth promotant.

Key words: Oestradiol, feed conversion ratio, buffalo

INTRODUCTION

Research for the last 20 years revealed that supplementation of ruminants on low quality forage has an effect productivity through increase efficiency of feed utilisation. The efficiency could be further increased if the hormone millieu is favourable that is by repartitioning the nutrient absorbed to the target tissue. Growth promotants which have been commercially produced by recombinant DNA technology has clearly illustrated the possible manipulation of hormonal millieu to increase the rate and efficiency of growth. One of those is oestradiol 17 ß which was found to affect the circulating growth hormone (TRENKLE 1983, ENRIGHT *et al.*, 1990) and insulin (TRENKLE, 1983) concentration and the number of hepatic growth hormone receptor (BREIER *et al.*, 1988). This in turn stimulates muscle protein deposition as shown in experiment by DAWSON *et al.*, (1991). However, the effect of oestradiol is only achieved if dietary protein levels are adequate (GILL *et al.*, 1987, DAWSON *et al.*, 1991).

CHULDLEIGH *et al.* (1982) treated steers with oestradiol 17 ß improved weight gains by 0.04 to 0.1 kg/d (7 to 20 %) and WELLINGTON (1985) reported similar increases following treatment with zeranol or oestradiol 17 ß. SAWYER *et al.* (1987) compared the growth response of untreated steers calves with those given a long acting oestradiol 17 ß in silicone rubber implant or implants of zeranol or oestradiol-progesterone found that oestradiol 17 ß was the only product that significantly increased weight gain compared to control (0.68 vs 0.52 kg/d, 18.2% advantage). Furthermore, oestradiol 17 ß showed a similar increases in weight gain both at low and high planes of nutrition suggesting that the implant maintaining a continuously high level of circulating anabolic agent during the experiment. Although there have been reports of the effect of growth promotants on cattle growth, reports on buffalo have not been available.

The following experiment was designed to test the effect of oestradiol 17 ß on the liveweight gain and feed conversion ratio in buffalo.

MATERIALS AND METHODS

Animals and experimental design

Ten buffaloes (4 steers and 6 heifers) were assigned into two treatment groups in stratified randomisation

according to body weight. The two treatment groups were: I, Control and II, Oestradiol (Compudose) implant. The implant consists of a 3 cm long silicone rubber covered with a special layer of silicone rubber into which is impregnated a 24 mg crystals of oestradiol 17 ß. It incorporates a unique delivery system to ensure an even release of the natural hormone over a 200 day period. The implant was inserted subcutaneously in the middle of the back of buffalo's left ear.

The animals were kept in individual cages and were offered chopped elephant grass (*Pennisetum purpureum*) *ad libitum* plus concentrate feed at a rate of 1% body weight. The concentrate feed was made by the local dairy cooperative consisting of wheat pollard (50%), coconut meal (8%), corn meal (11.5%), palm kernel cake (6%), cocoa shell (7%), soy bean meal (4%), kapok seed meal (5.5%), fish meal (3%) and mineral vitamin mix (5%). Data on the chemical composition of elephant grass and concentrate feed is presented in Table 1. Water was available at all times.

Table 1. The chemical composition of elephant grass and concentrate feed used in the experiment

Nutrient	Elephant grass	Concentrate feed
Crude protein (%)	8.3	16.4
NDF (%)	68.6	42.1
Fat (%)	2.5	6.1
Ca (%)	0.40	1.09
Na (%)	0.06	0.66
P (%)	0.36	0.89
Mg (%)	0.38	0.45
ME (MJ/kg)*	7.0	10.4

* ME = 0.15 x DOMD (*in vitro* digestion)

Measurements

The intake of elephant grass was measured daily; the feed and feed refusal were bulked for weekly dry matter determination.

In vitro digestion described by TILLEY and TERRY (1963) was carried out to estimate digestible organic matter (DOMD) of both elephant grass and concentrate feed. Two Ongole bulls equipped with rumen fistula served as donor animals to provide rumen fluid for *in vitro* measurement.

Liveweight was measured by weighing the animals every second week for 154 days.

Chemical analysis

The dry matter, ether extract (fat), crude protein and minerals of the feed were determined by AOAC procedures whereas neutral detergent fibre (NDF) was measured according to GOERING and VAN SOEST (1970) method.

Statistical analysis

Differences attributed to the implantation of oestradiol 17 ß were evaluated against the control by Student's t test. All data were computed using the Statistix 3.0 program (NH Analytical Software, USA).

RESULTS AND DISCUSSION

There were tendency that liveweight gain, dry matter intake per unit live weight (DMI/LW) and feed conversion ratio in oestradiol-implanted animals were improved compared to that in non-implanted animals. However, those parameters were only significant at $P<0.10$ level due to the small number of animals, variation in sex and live weight within treatment.

It appeared that in buffalo, feed intake was enhanced (26.5 vs 24.9 g/kg LW) by oestradiol implantation, resulting in an increase (0.89 vs 0.68 kg/d) in average daily gain of implanted animals over control animals (Table 2 and Table 3). Similar result was also obtained by GILL *et al.* (1987) and DAWSON *et al.* (1991) where feed intake of fish meal supplemented-steers was further increased and similarly growth rate was also enhanced by implantation of oestradiol.

Table 2. The live weight of animals at the start and end of the experiment, total liveweight gain (LWG), total intake of dry matter (DMI), mean dry matter intake per kg live weight (DMI/LW) and feed efficiency (F/G) of control and oestradiol-implanted animals over period of 154 days

Treatment	Animal No	Sex	Live weight (kg) Start	End	LWG (kg)	DMI (kg)	DMI/LW (g/kg)	F/G
Control	441	♀	198	288	90	956.5	25.0	10.63
	449	♀	172	270	98	999.6	25.5	10.20
	172	♀	354	460	106	1,267.7	23.1	11.96
	380	♂	294	424	130	1,484.7	26.2	11.42
	448	♂	206	305	99	1,168.2	24.8	11.80
	Mean				104.6	1,175.3	24.9	11.24
	SE				6.13	85.8	0.46	0.30
Oestradiol	390	♀	298	454	156	1,510.2	25.9	9.68
	450	♂	196	340	144	1,159.3	28.8	8.05
	399	♀	280	414	134	1,409.4	25.9	10.52
	446	♀	210	332	122	1,104.8	25.8	9.06
	442	♂	212	340	128	1,141.3	26.2	8.92
	Mean				136.8*	1,265.0	26.5*	9.24*
	SE				5.38	73.2	0.51	0.37

* Significant at $P<0.100$

Reports on other anabolic agents, trembolone acetate and zeranol also indicated that the agents enhance voluntary feed intake (SINNETT-SMITH *et al.*, 1983).

In the present experiment, there was approximately 20 % increase in gross efficiency of protein gain (6.25 N) in animal treated with oestradiol (Table 3). This value was higher than that found by GILL *et al.* (1987) where efficiency of N retention in steers supplemented with fish meal was further improved (12%) by oestradiol implantation. However, the absolute values for efficiency of N retention obtained by GILL *et al.* (1987) were higher than that obtained in this experiment. The difference in values is probably due to the fact that an estimation of N retention would reflect the mean rate of N retention at a point in time i.e. a 7 day period conducted by GILL *et al.* (1987) whereas the estimated protein content of gain (0.2 x weight gain) obtained in this experiment would reflect the integrated rates of accretion of body N over a much longer period of time (i.e. 154 days).

Table 3. The protein intake, metabolisable energy intake (MEI), ratio of protein gain : protein intake, metabolisable energy intake per average daily gain (MEI/ADG), average daily gain (ADG) of implanted and control animals and the advantage and improvement of oestradiol implanted animals over control

Treatment	Control	Oestradiol
Protein intake (g/d)	958	1,043
MEI (MJ/d)	72.3	76.3
Protein gain:Protein intake *	0.142	0.171
MEI/ADG (MJ/g)	0.106	0.086
ADG (kg/d)	0.68	0.89
Advantage over control (kg)		32.2
% improvement		31.0

* assuming protein gain is 0.20 body gain

Oestradiol-treated animals appeared to be more efficient in utilising metabolisable energy to body gain compared to control animals (Table 3). This suggests that the anabolic agent plays an important role in directing the nutrient for body gain presumably through increase in circulating growth hormone and insulin concentration (TRENKLE, 1983; ENRIGHT *et al.*, 1990) and high affinity of growth hormone receptor (BREIER *et al.*, 1988) which promotes growth (GLUCKMAN and BREIER, 1989). Furthermore, it could be speculated that animals treated with oestradiol had a higher proportion of lean muscle compared to the control (DAWSON *et al.*, 1991). It is also speculated that in control animals both the concentration of circulating GH and the affinity of GH binding site would be lower (GLUCKMAN and BREIER, 1989) but insulin concentration would be higher (MUNRO and BICKERSTAFFE, 1987) than in oestradiol treated-animals.

Buffaloes treated with oestradiol showed 31% and 18% increase in liveweight gain and feed conversion ratio, respectively compared to control animals (Table 2 and 3). These increases were calculated over a period of 154 days where the animals experienced in getting short and high supplies of elephant grass. The oestradiol 17 ß implant has a long acting delivery system releases the hormone evenly over a 200 or 400 days period (Elanco products) and so that on lower plane of nutrition oestradiol still increases weight gains (SAWYER *et al.*, 1987). Reports on the improvement in liveweight gain of animals treated with oestradiol have been variable ranging from 7 to 32% depends on the type of feed, sex and animals. In this experiment, since the number of experimental animal is too small, differences between sex in treated animals could not be detected (136 kg vs 137 kg). HEITZMAN (1980) pointed out that if anabolic agents either oestrogens or androgens are used, the concentrations of oestrogens in the circulation should not be less than those observed in adult cow, and the plasma concentration of androgens should be similar to those in bull plasma. Therefore, it is anticipated that the best responses are obtained when androgens are used in females and oestrogens are used in males (Table 4). Combined preparations of androgens plus oestrogens improve the response further as shown in Table 4.

Table 4. Growth stimulation of cattle by anabolic agents

Preparation	Animal	% increase in daily weight gain	Ref
Oestradiol	steers	13	BUTTERY (1985)
		32	DAWSON *et al.* (1991)
Oestradiol	heifers	19	BUTTERY (1985)
Oestradiol + testosterone propionate	heifers	19	BUTTERY (1985)
Trembolone*	steers	9	HEITZMAN (1980)
		10	HEITZMAN (1980)
		11	HEITZMAN (1980)
		24	HEITZMAN (1980)
Trembolone	heifers	70	HEITZMAN & CHAN (1974)
Trembolone + oestradiol	steers	46	BUTTERY (1985)
Trembolone + Zeranol**	steers	51	HEITZMAN (1980)

* androgenic
** oestrogenic

Increased (18%) feed conversion ratio in oestradiol treated-animals implies that the use of growth promotant results in higher economic return. If we assumed that the ADG was constant to slaughter time (200 days) then, there would be an advantage of 42 kg of the treated animal over control. When account is taken on the cost of the implant (US $ 3 equivalent to Rp 6800) and live animal sale is Rp 4000/kg, farmers would get a benefit of Rp 161200 per animal.

Oestradiol like other growth promotants, testosterone and progesterone is naturally occurring hormone. HOFFMAN (1984) pointed out that the naturally occurring hormone (endogenous steroids) has a low bioavailability because they are readily biodegraded when entering the entero-hepatic circulation in man and animals. As it is reported by BUTTERY (1985) that the endogenous hormone status in human would not be interfered by consuming meat treated with anabolic agents (Table 5). The amount of hormone from meat treated and untreated animals is insignificant compared to hormone production in human. Therefore, it is safe to consume meat from animal treated with growth promotant such as oestradiol.

Table 5. Human intake of anabolic steroids from meat treated with a variety of preparation containing oestrogen compared with endogenous hormone production[1)]

	Oestrogen	Progesterone	Testosterone
Production in human: (µg/d)			
Adult-male	136	416	6840
Woman: during cycle	190 - 1600	418 - 196000	240
late pregnant	64300	294000	320
post menopausal	46	150	140
Prepubertal child	42	150	32
Max amount in 250 g meat: (µg)			
Untreated cattle	0.11*	2.5*	0.13+
Treated steer	0.005	0.15	0.0006
Treated heifer	0.005	-	0.025

* pregnant cow
\+ mature bull
1) adopted from BUTTERY (1985)

In the tropics where most developing countries exist, the increased animal production has been largely due to increased animal numbers, while production per animal has been static or increased to a minor extent. The level of production of ruminants in the tropics is only half of their genetic potential (MANNETJE, 1981) because of deficiencies in the diet (LENG, 1992). Correction of nutrient deficiencies by feed supplementation combined with growth promotant such as oestradiol could improve animal production to the level similar to that from the temperate region.

CONCLUSION AND RECOMMENDATION

Observation from the present study indicates that oestradiol increased live weight gain and feed conversion ratio of buffalo resulting in higher economic return. However, similar trial should be conducted extensively, preferably on beef cattle with further examination of the hormone concentration in meat of treated animals. Different quality of diet should be tested so that information can be given as to what extent oestradiol affects animal production. Animal number of both sexes used in the trial should be large enough so that differences between treatments could be assured. Although oestradiol 17 ß (Compudose) has gained approval to use in developed country, Indonesian government has not yet approved it. Therefore, an extensive study which would be anticipated to give a positive result would be an answer.

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