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Feeding a natural plant extract affects growth performance in beef cattle*

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ABSTRACT

This study was conducted to investigate the effect of natural plant extract (NPE) on the growth performance and feed conversion efficiency in beef cattle. Growing crossbred steers were fed pasture hay *ad libitum* and 2.5 kg/day for two months, then 3.0 kg/day for a further four months, of a maize/soya bean based concentrate. Half the steers were offered a supplement of a dried extract of a mixture of NPE at the rate of 6 g supplement per kg of concentrate. By comparison with the steers fed the control concentrate supplement, those fed the concentrate containing the NPE had better weight gain ($P<0.05$). During the fifth and sixth month of the experiment the efficiency of use of feed for liveweight gain increased significantly ($P<0.01$) in the cattle fed the supplement containing NPE compared to those fed the control supplement. It will be of interest to determine the nature of the active component(s) of NPE which is/are responsible for mediating the effects on growth performance in beef cattle in further study.

KEY WORDS: natural plant extract, growth performance, feed conversion, beef cattle

INTRODUCTION

There are a number of reports that addition of extracts of 'medicinal plants' to the diets of farm animals leads to improved nutrient utilization, metabolism, immunological function, growth and also carcass and meat characteristics (Wang and Zhou, 1996; Hua and Wu, 1998; Zhang et al., 2002; Li et al., 2005.) The use of these natural products as substitutes for antibiotics and other agents is attractive

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because of concern about the potentially harmful residues of bioactive substances in animal products such as meat (Wang, 2003; Liu and Zhang, 2006). However, there was little information about the effect of the NPE on the beef growth performance and feed conversion efficiency. The present study was conducted with the view to monitoring whether supplementation of the diet of beef cattle with natural plant extract affects growth performance and feed conversion efficiency.

MATERIAL AND METHODS

Animals and feeding

Twelve growing beef cattle steers [Brahman ♂ × (Murray Grey ♂ × Yunnan Yellow ♀)], 15 months of age and with similar liveweight (370 kg) were housed indoors and fed a basal diet, consisting of pasture hay (8.35 MJ ME /kg dry matter) *ad libitum* which was supplemented with a concentrate based on maize grain and soya bean protein (Table 1). Initially all the cattle were offered the basal ration

Table 1. Components (g/kg air dry) of the control (CON) concentrate supplement and the concentrate supplement containing the natural plant extract (NPE).

Item	Concentrate supplement	
	CON	NPE
Component		
maize	686	680
maize protein (60% CP)	100	100
soya protein	80	80
cole seed protein	60	60
soya oil	24	24
calcium phosphate	14	14
sodium chloride	7	7
stone meal	24	24
urea	15	15
vitamin and mineral premix¶	10	10
natural plant extractψ	-	6
Nutrients		
crude protein	162.6	163.0
ether extract	67.8	68.2
crude fibre	47.1	47.1
ash	30.6	30.6
phosphate	6.3	6.3
Ca	9.6	9.6

vitamin premix supplied per kg of diet, IU: vit. A 220, vit. 120 D_3, vit. E. 12.5
mineral premix supplied per kg of diet, g: $MgSO_4 \cdot 7H_2O$ 5.1, mg: $FeSO_4 \cdot 7H_2O$ 303, $CuSO_4 \cdot 5H_2O$ 40.8, $ZnCO_3 \cdot 7H_2O$ 142, $MnSO_4 \cdot H_2O$ 69, KI 0.36, $NaSeO_4$ 1.0

plus 2.5 kg/day of the concentrate supplement for 10 days. Thereafter half cattle received a supplement of NPE at the rate of 6 g/kg of concentrate fed and another half fed the concentrates without NPE as control. After 2 months the amount of the concentrate supplement was increased to 3 kg/day. The concentrate supplement was offered in three equal portions each day at 08.00, 12.30 and 17.00 h whereas the basal hay ration was offered once daily at 08.00 h. Intakes of hay and concentrate supplement were recorded daily. Water was available *ad libutum* throughout the experiment. The cattle were weighed at the start of the experiment then once each month prior to allocation of fresh feed (i.e. 14 h form last allocation of the concentrate supplement).The feed intake including concentrates and hay were recorded daily for calculating the feed conversion efficiency

Natural plant extract

The NPE was prepared from a mixture of "medicinal plants" by steam distillation using the procedure reported by Xie and Zhang (2003). All plant material used for the preparation of the NPE was purchased from the Chinese Herbal Medicine Market in Kunming, Yunnan Province. The plants purchased were: milk vetch root (*Radix astragali*), root of angelica (*Angelica pubescens, Maxim*), loquat leaf (*Eriobotrya japonica, Lindle*), root of herbaceous peony (*Paeonia lactiflora*), white peony (*Paeonia alba*), Indian bread (*Poria cocos*), Przewalski sage root (*Salvia Przewalski*), Chinese arborvitae kernel (*Semen platycladi*), silktree siris (*Albizzia julibrissin, Durazz*), Rangoon creeper fruit (*Fructus Quisqualis*), areca seed (*Semen arecae)*, houpu magnolia bark (*Magnoliae officinalis*), immature orange fruit (*Aurantii immaturus, fructus*), pharbitidis purpurea (*Semen pharbitidis*), rhubarb (*Radix et rhizome, Rhei*), prepared liquorice root (*Glycyrrhiza uralensis*), Chinese thorowax root (*Radix bupleuri*), common selfheal fruit spike (*Prunella vulgaris Spica*), clore (*Flos caryophylli*), fennel (*Fructus Foeniculi*), white mulberry root bark (*Morus alba* L.), dried ginger powder (*Zingiber officianale roscoe*), lilac daphne flower bud (*Daphne genkwa*), largehead atractylodes rhizome (*Atractylodis macrocephalae, rhizoma*), pinella tuber (*Rhizoma pinelliae*), rhizome, hawthorn fruit (*Crataegus - oxyacantha* L.), and dried tangerine peel (*Pericarpium citri reticulatae*). The active constituents of the NPE were, %: polysaccharides 16.49, saponin 3.10, alkaloids 1.65, quinone 1.65, and flavones 0.74.

RESULTS

The effects of addition of NPE to the diet are summarized in Table 2. Inclusion of the NPE in the diet led to a significant increase ($P<0.05$) in liveweight gain over the experiment with most of the increase attributable to a

Table 2. Growth performance from cattle offered either the control supplement (CON) or the supplement containing the natural plant extract (NPE)

Parameter	Supplement offered	
	NPE	CON
Initial LW, kg	371.0 ± 16.70	379.6 ± 33.45
Finial LW, kg	514.4 ± 19.93[a]	503.2 ± 25.55[b]
Weight gain, kg	143.4 ± 12.12[a]	123.6 ± 9.56[b]
Months 0 to 2		
daily weight gain, kg/day	0.75 ± 0.09	0.67 ± 0.09
feed conversion, F/G kg	9.03 ± 0.98	10.18 ± 0.12
roughage intake, kg DM/kg	4.56 ± 0.30	4.61 ± 0.13
concentrate intake, kg DM/kg	2.21 ± 0.00	2.21 ± 0.00
Months 3 to 4		
daily weight gain, kg/day	0.83 ± 0.12	0.71 ± 0.23
feed conversion, F/G kg	8.91 ± 1.54[A]	11.80 ± 0.32[B]
roughage intake, kg DM/kg	4.56 ± 0.31	4.74 ± 0.47
concentrate intake, kg DM/kg	2.64 ± 0.00	2.64 ± 0.00
Months 5 to 6		
daily weight gain, kg/day	0.82 ± 0.12[A]	0.68 ± 0.19[B]
feed conversion, F/G kg	9.42 ± 0.39[A]	11.79 ± 1.11[B]
roughage intake, kg DM/kg	4.75 ± 0.32	4.96 ± 0.52
concentrate intake, kg DM/kg	2.64 ± 0.00	2.64 ± 0.00

values are means ± standard errors of means and differ significantly at [a,b] $P<0.05$, [A,B] $P<0.01$

significant increase ($P<0.01$) during last two months of the experiment, thus, the liveweight gain per day of cattle fed the NPE was significant increased by 20.6%. Similarly, the efficiency of use of feed for liveweight gain increased significantly ($P<0.01$) during the latter two months of the study.

DISCUSSION

It was reported previously that the addition of a plant extract, similar to that used in the present study, to the diets of Charolais and Simmental cattle for three months resulted in enhanced growth and improved efficiency of utilization of nutrients to support growth (Liu et al., 2001). In another study where hybrid cattle were fed an extract of different medicinal plants for 40 days improved growth and carcass composition were recorded (Liu and Sun, 2000). More recently, Jia et al. (2007) provided a preliminary report that supplementation with the NPE used in the present study increased growth and the tissue contents of lipids in the cattle used in the present study.

Extracts of medicinal plants are known to contain a number of bioactive constituents including alkaloids, polysaccharides, saponin, quinone and oils which affect secretion of hormones and alter metabolism in farm animals (Zhang et al., 2005). Oligosaccharides have been used as prebiotics to influence the composition of the bacterial populations in the large intestine of a number of animal species (Grizard et al., 1999; Rycroft et al., 2001). The mannose-oligosaccharide (MOS) supplementation resulted in improved production in terms of body weight gain and feed conversion (Parks et al., 2001) and significant improvement in antibody responses (Cotter et al., 2000). The polysaccharides from astragalus and tomato added to the diet have been reported to increase disease resistance in chickens by enhancing immune responses (Hua and Wu, 1998; Gao et al., 2000). Others have reported that addition of astragalus polysaccharide to the diets of chickens has increased the activity of alkaline phosphatase as well as concentrations of albumin and total protein in serum with enhanced disease resistance and improved growth and efficiency of feed use (Li and Zhao, 2005). The results of the present study provide clear evidence that supplementation of the diet of beef cattle with NPE significantly increased liveweight gain and improved the efficiency of feed conversion in beef cattle. This may due to the bioactive substance of the NPE, influence on the metabolism.

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