

# Influence of Genotypes and Feeding on Growth and Sensory Characteristics of Goat Meat

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## ABSTRACT

Eighteen, 6 each of Thai native (TN); 25% and 50% Anglo-Nubian (AN) post-weaning male goats were used to study the effects of genotype and feed intake levels on growth and sensory quality of goat meat. The goats were fed at three levels; high (*ad libitum*) or 1.9 maintenance (1.9M), medium (1.2M) and low (M). Slaughtering of goats was performed after 97 days of feeding. There were no significant ( $P>0.05$ ) differences between genotypes, while feeding levels had significant ( $P<0.01$ ) effects on growth rate, empty body and carcass weights. The higher the feeding levels, the greater weight gained per day, empty body weight (EBW) and carcass weight. Genotype had a significant ( $P<0.01$ ) effect on the sensory quality of goat meat. Meats of AN crossbred goats were more acceptable and had less goaty flavour than those of the TN goats. To some extent, feeding levels significantly ( $P<0.05$ ) affected the sensory characteristics of goat meat. Meat of higher level fed goats had more intense and goaty flavour with lower acceptability. There were no significant interaction effects between genotype and feeding for growth rate, EBW, carcass weight and sensory characteristics.

## INTRODUCTION

Chevon (goat meat) is one of the red meats (pork, beef, lamb, mutton and chevon) and is a major source of protein in many countries. It is relished throughout Asia (Devendra, 1979; Ahmed and Alvi, 1988; Bhattacharyya and Khan, 1988; Djajanegara and Chaniago, 1988; Hug, 1988; Ibarra, 1988; Kharel and Pradhan, 1988; Rajaguru, 1988; Saithanoo and Milton, 1988; Vidyadaran, Rajion and Tuen, 1988; Wenxin, 1988). Goat meat production in Thailand is primarily in villages of the southern region where the Thai Muslim population is relatively high.

The acceptabilities of red meat are determined generally by their flavour (Wasserman, 1979; Moody, 1983). Genetics, type of feed and environment influence meat flavour. Species is the most important genetic factor while the effect of breed is less widely

recognized (Sink, 1979; Crouse, 1983). Feed source is an important environmental factor (Bowling, Smith, Carpenter, Dutson and Oliver, 1977; Field, Williams and Miller, 1983; Melton, 1983; Devendra, 1988; Melton, 1990). Consumption of goat meat is limited to certain groups. Discrimination against goat meat is mainly associated with "goaty" odour. This chevon flavour is reported to be primarily associated with 4-methyloctanoic and 4-methylnonanoic acid (Wong, Nixon and Johnson, 1975; Cramer, 1983).

The objectives of this experiment were to study the effects of Thai native and Anglo-Nubian crossbred goats and feeding regimes on growth and flavour characteristics of goat meat.

## MATERIALS AND METHODS

### Experimental Animals

A total of 18 post-weaning male goats consisting of 6 Thai native (TN), and 6 each of 25% and 50% Anglo-Nubian (AN) crossbred goats were used. This flock of goats was obtained from the study of growth and body composition of TN and TN x AN male weaner goats (Pralomkarn, Kochapakdee, Saithanoo and Norton; in press). Each genotype was divided into 3 groups for 3 different levels of feeding regime; high (*ad libitum*, 1.9M), medium (1.2M) and low (M).

The experiment followed a complete factorial design with 2 factors; growth rates (3 levels) and genotypes (3 levels).

### Feeding Regimes

The feed consisted mainly of concentrates and 50 grams per day of dry hay to maintain the stomach fermentation. The concentrates consisted of 30% palm oil kernel cake, 44% corn, 17% soybean meal, 5% fish meal, 2% salt, 1% dicalcium phosphate, 1% oyster shell, 5,000 IU of vitamin A and 100 IU of vitamin D. Ten percent molasses was incorporated with the concentrates. The feeding of goats was performed for 97 days prior to slaughtering.

### Weight and Carcass Measurements

The experimental goats were weighed every 2 weeks and then slaughtered by exsanguination at the end of the feeding period. After removal of the digestive tracts, the empty bodies and carcasses were weighed, chilled and frozen for sensory analysis.

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## Sensory Analysis

One half of each of the frozen carcasses was used for sensory analysis. The carcasses were thawed in a 4°C refrigerator for 24 hours. A sample of ground meat from each animal using lean muscle of hind quarter was prepared. The sample was prepared each day by grinding through a Kenwood meat grinder. The ground meat sample from each carcass was thoroughly mixed once to obtain a homogeneous mixture. Four hundred grams of meat sample was placed in a 600 mL beaker, covered with a watch glass and cooked in a microwave oven on the high setting for 7 minutes.

The sensory analysis was performed using the quantitative descriptive attribute (QDA) method (Stone, Sidel, Oliver, Woolsey and Singleton, 1974). The sensory panel consisted of seven trained panelists. A continuous non-structured scale was used for evaluation. A 6 inch line anchored on the left side with lowest intensity of each attribute and the right side with highest intensity was given. The attributes evaluated were goaty and grassy for aroma and goaty, grassy, pungent for flavour and acceptability.

One tablespoon of cooked ground meat sample was immediately placed into small glasses. Each panelist was given cooked samples kept warm in a hot sand bath. Samples were served in random order.

## Statistical Analysis

Analysis of variance for the completely randomized design was performed on the data collected for the effects of genotypes and feeding levels using the SAS program (1987). Least squares means for significant ( $P < 0.01$ ) main effects, or interactions, were separated using a least significant difference (LSD) test and a probability level of 5% ( $P > 0.05$ ) and 1% ( $P > 0.01$ ).

## RESULTS AND DISCUSSION

### Growth of the Goats

Goat production in Thailand is mainly for meat consumption. Thus, their characteristics as meat producers are very important. In this present study, growth of the goats related to genotypes and feeding regimes were investigated. Least squares means of growth rate, empty body weight (EBW) and carcass weight (CW) are listed in Table 1. There were three levels of growth rate; 10.6 g/kg<sup>0.75</sup>/d (high), 8.4 g/kg<sup>0.75</sup>/d (medium) and 1.6 g/kg<sup>0.75</sup>/d (low). There were no significant differences among genotypes (TN, 25% and 50% AN goats) in growth rate, empty body and carcass weight. However, both genotypes of crossbred goats gained weight faster in all three categories.

Feeding levels had significant ( $P < 0.01$ ) effects on growth rate, empty body and carcass weight. Goats

fed *ad libitum* had significantly higher daily weight gains, EBW and carcass weights than those fed with medium and low planes of nutrition. Animals fed at the medium (1.2M) level reached significantly higher weights than those fed at the low (M) level.

Table 1 Least squares means of growth rate, empty body weight and carcass weight of goats different genotypes and feeding levels.

	Growth Rate (g/kg <sup>0.75</sup> /d)	Empty Body Wt (kg)	Carcass Wt (kg)
Genotype (G)			
TN	6.4	18.2	10.1
25% AN	6.7	18.4	10.2
50% AN	7.5	19.0	10.4
Feeding level (F)			
High	10.6 <sup>a</sup>	23.1 <sup>a</sup>	13.0 <sup>a</sup>
Medium	8.4 <sup>b</sup>	18.1 <sup>b</sup>	10.0 <sup>b</sup>
Low	1.6 <sup>c</sup>	14.4 <sup>c</sup>	7.7 <sup>c</sup>
SEM <sup>1</sup>	0.23	0.63	0.38
G	NS	NS	NS
F	**	**	**
G x F	NS	NS	NS

<sup>1</sup> Standard error of mean, values within columns between treatments with differing superscripts differ significantly, \*\* ( $P < 0.01$ ), NS = not significant

### Flavour Characteristics of Goat Meat

The least squares means of quantitative descriptive analysis (QDA) scores for the effects of genotypes on sensory quality of goat meat are listed in Table 2. Significant differences ( $P < 0.01$ ) of goat genotypes were found on five (5) sensory attributes (goaty-aroma, goaty-flavour, grassy-flavour, pungent and acceptability) while there was no significant difference on grassy-aroma. Meats of AN crossbred goats were more acceptable in terms of aroma and flavour. The higher percentage of cross-breeding, the more acceptable the meat produced. Although species flavour are very pronounced (among beef, pork, lamb or goat meats), goat breeds may also differ in their flavour quality (Course, 1983). Casey (1992) reported that meat of Angora goats had a more acceptable flavour than meat of Boer goats. For visual impact, differences in sensory characteristics among meat of different genotypes are clearly displayed in the QDA plot (the so-called sunray plot or spider web) in Figure 1. The figure illustrates that greater acceptability of the meat from the higher percentage of AN goats was obtained. The sensory characteristics of meat of 25% and 50% AN goats were not significantly different.

**Table 2** Least squares means for the main effects of genotype and feeding on sensory characteristics of goat meat.

	Aroma		Flavour			Acceptability
	Goaty	Grassy	Goaty	Grassy	Pungent	
Genotype (G)						
TN	3.60 <sup>a</sup>	3.30	3.35 <sup>a</sup>	2.94 <sup>a</sup>	2.77 <sup>a</sup>	2.94 <sup>a</sup>
25% AN	3.33 <sup>a</sup>	2.84	2.88 <sup>b</sup>	2.46 <sup>b</sup>	2.24 <sup>b</sup>	3.34 <sup>b</sup>
50% AN	3.06 <sup>b</sup>	2.94	2.64 <sup>b</sup>	2.49 <sup>b</sup>	2.11 <sup>b</sup>	3.62 <sup>b</sup>
Feeding level (F)						
High	3.26	3.05	2.99 <sup>a</sup>	2.67	2.35	3.32 <sup>a</sup>
Medium	3.51	3.11	3.20 <sup>a</sup>	2.67	2.55	2.98 <sup>a</sup>
Low	3.21	2.93	2.67 <sup>b</sup>	2.53	2.21	3.61 <sup>b</sup>
SEM <sup>1</sup>	0.08	0.08	0.08	0.07	0.08	0.08
G	*	NS	**	*	**	**
F	NS	NS	*	NS	NS	**
G x F	NS	NS	NS	NS	NS	NS

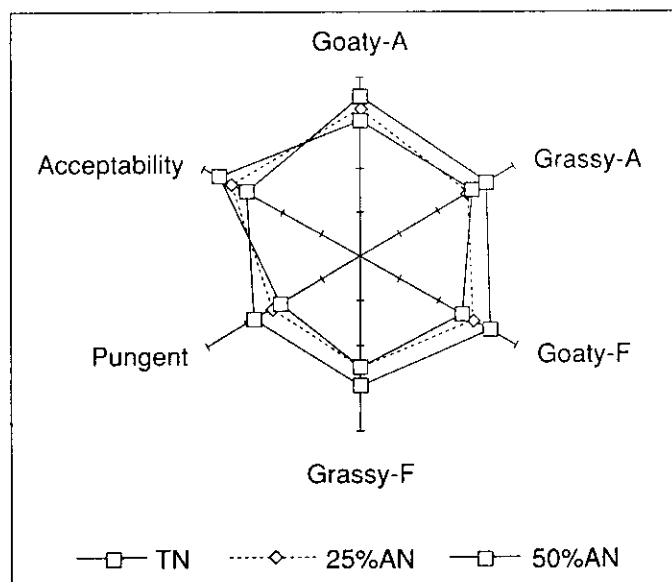
<sup>1</sup> Standard error of mean, values within columns between treatments with differing superscripts differ significantly,

\* ( $P < 0.05$ ),

\*\* ( $P < 0.01$ ), NS = not significant

The least squares means of QDA scores for various feeding levels are also presented in Table 2. Two of six (6) sensory attributes (goaty-flavour and acceptability) were significantly ( $P < 0.01$ ) affected by different levels of feeding. However, there were no significant differences in sensory scores for goaty-aroma, grassy-aroma, grassy-flavour and pungent flavour. Regardless of breeding, meat of goats fed with higher feeding levels had inferior sensory

characteristics to those fed with lower levels. The effects of diet ingredients and levels of feeding on red meat flavour are dependant on the type of diet. In general, high-energy grain diets produce a more acceptable or a more intense flavour in red meat than low-energy forage or grass diets (Field *et al.*, 1983; Melton, 1983 and 1990). In this study, meat of higher level fed goats had less acceptable sensory characteristics. Although the composition of diet ingredients was the same for all levels of feeding, the same amount of dry hay to maintain the stomach fermentation of the goats and different levels of feeding may cause differences in flavour and acceptability of meats. Higher levels of feeding may produce larger amounts of subcutaneous fat and marbling in lean muscle resulting in more intensity of goaty flavour. Figure 2 displays a spider web plot of QDA mean scores of the effect of feeding on sensory characteristics. The figure illustrates that low levels of this particular diet produced lower goaty flavour and more acceptable goat meat. This finding suggests more work on diet ingredients and feeding regimes is needed to understand the effect of feeding levels on sensory characteristics of goat meat. Various levels of concentrate supplement need to be investigated if a high level of production is desired. Furthermore, more research on the interaction between genotypes of goats and different kinds of feed is needed.



**Fig. 1** Plots of least squares means on sensory characteristics of goat meats from different genotypes.

In summary, although there were no significant

differences among genotypes of goats on growth rate, EBW and carcass weight, 25% and 50% AN crossbred goats produced slightly higher numbers in all categories. Feeding levels effected growth rate, EBW and carcass weight. To some extent, breeding and feeding have effects on sensory quality and acceptability of goat meat. Goaty and grassy flavour were clearly associated with breed. The higher AN breed percentages resulted in less goaty and grassy flavour intensity. In contrast to breeding, high levels of feeding produced more intense flavour characteristics and less acceptable goat meat.

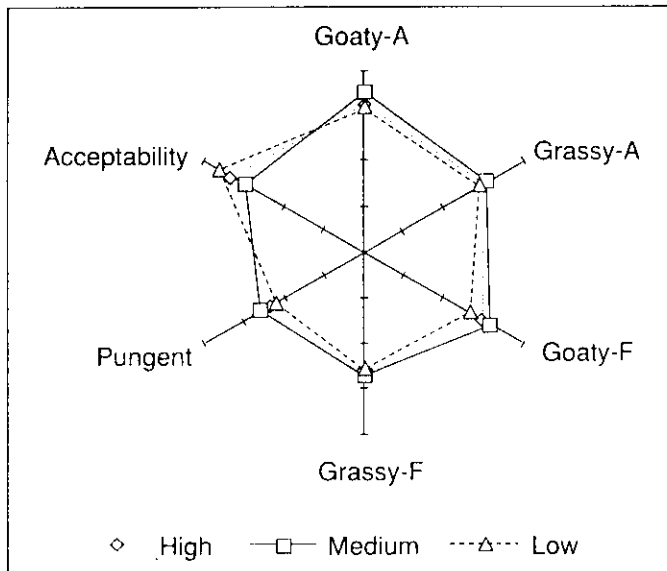


Fig. 2 Plots of least squares means on sensory characteristics of goat meats from different feeding levels

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